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VEGETATIVE EROSION CONTROL STUDIES TENNESSEE-TOMBIGBEE WATERWAY--ETC(U)
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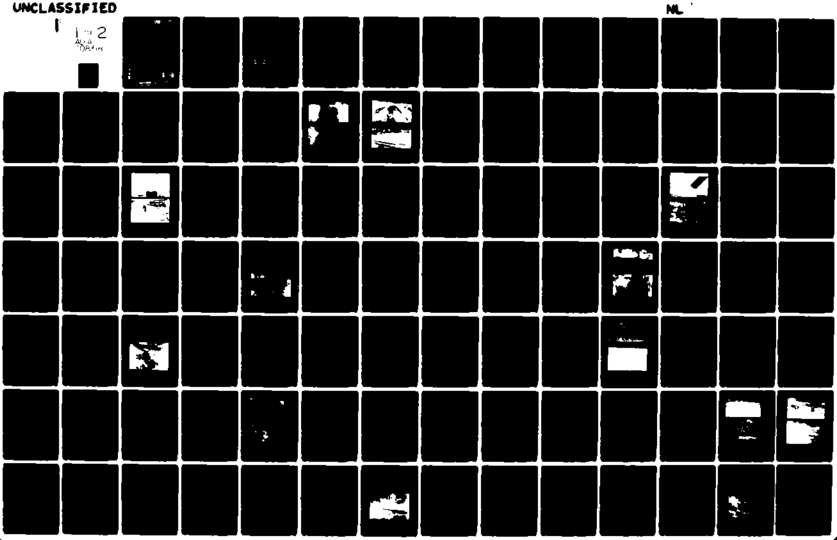

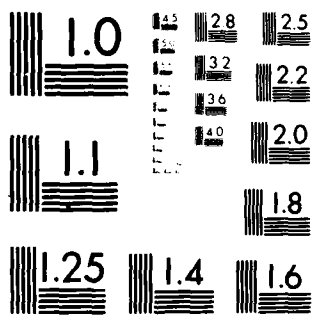

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DEPARTMENT OF AGRONOMY

FINAL REPORT

VEGETATIVE EROSION CONTROL STUDIES

TENNESSEE-TOMBIGBEE WATERWAY

CONDUCTED FOR

U. S. ARMY CORPS OF ENGINEERS, NASHVILLE DISTRICT,

OHIO RIVER DIVISION

BY

MISSISSIPPI AGRICULTURE AND FORESTRY EXPERIMENT STATION

MISSISSIPPI STATE, MISSISSIPPI

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Vegetative erosion control studies of establishment, overseeding, and refertilization were conducted at two sites in Tishomingo Co., MS (Yellow Creek Port Site and Tennessee-Tombigbee Waterway Site) that were most representative of the Tenn-Tom Waterway slopes and spoil areas from August, 1976 thru October, 1980. Primary objectives were focused on species selection, seeding rates, mulch evaluations, post-establishment fertilization and overseeding. Species shown to be well adaptive to site and soil conditions were weeping lovegrass, tall fescue, rye, annual ryegrass, bahiagrass, sericea lespedeza, and crimson clover; common bermudagrass

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20. (cont.) and hairy vetch showed moderate adaptation. Comparison of seeding rates, mixtures, and seed distribution methods of either mixed or contour seeding were evaluated as well as straw-asphalt seed mulch and nylon-paper webbing mulch. Overseeding was performed to integrate plant species into or increase the density of an established vegetative stand. Cultivation practices of burning, discing, and clod-busting were evaluated with clod-busting being the most effective method. Refertilization with nitrogen was evaluated as a short term maintenance practice to maintain slope stabilization prior to overseeding. Regrowth of the established stand following overseeding was greater with prior nitrogen fertilization. Plant response to nitrogen fertilization (80 lbs N/acre) lasted two years.

DEPARTMENT OF AGRONOMY

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MISSISSIPPI AGRICULTURE AND FORESTRY EXPERIMENT STATION

MISSISSIPPI STATE, MISSISSIPPI

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January, 1981

Table of Contents

Introduction

The findings presented herein are based on research investigations conducted from August 3, 1976 to October 30, 1980. The research objectives undertaken were to investigate plant species selection, planting dates, seedbed preparation, seed mulches, and post-establishment maintenance (overseeding and/or refertilization) as related to soil erosion control. Plant species used for evaluation were selected based on their climatic adaptation and plant characteristics which lend themselves to rapid establishment and/or persistent growth. Mixtures of plant species were used to utilize selected plant characteristics to form a composite which provided immediate and long term soil stabilization. These mixtures were composed of both grass and legume species.

Research Objectives

1. To evaluate seeding rates and compositions of selected grass and legume seeding mixtures for controlling soil erosion on slope and spoil areas.
2. To evaluate the east and west slope exposure on the performance of selected grass-legume seeding mixtures to control soil erosion on slopes.
3. To evaluate selected legume species as components of a grass-legume seeding mixture to control soil erosion on slope and spoil areas.
4. To evaluate selected mulches for controlling soil erosion on slope area.
5. To evaluate post-establishment refertilization using nitrogen, phosphorus and potassium fertilizers and overseeding of established stand for controlling soil erosion on slopes.

Materials and Methods

Plant species used in the following investigations included numerous cool and warm season grasses and legumes. The warm season species were utilized for spring and summer seedings; whereas, the cool season species were used for fall and early spring plantings.

The following is a brief description of the plant species, cultural practices, and site locations of field plots used throughout the research period.

PLANT SPECIES USED

Bermudagrass:

Bermudagrass, a warm season perennial, is well adapted to the warm humid regions of the United States. Its northern boundaries of adaptation approach the northern boarders of Mississippi. Common bermudagrass is the most widely used variety of bermudagrass for soil erosion control of distributed soils. Hulled bermudagrass seed is generally used for soil erosion control situations and has been shown to establish more rapidly compared to unhulled seed. Germination time for common bermudagrass is 4-5 days under good field conditions. Common bermudagrass shows good heat and drought tolerances and tolerates a wide range of soil reaction ranging between 5.5-8.0 pH. Common bermudagrass has been shown to respond to applied soil lime when pH values are equal to or less than 5.5. Nitrogen requirements of common bermudagrass are generally higher compared to most other grasses used in low maintenance or soil erosion control situations. Common bermudagrass blends well with legumes and nitrogen

released from associated legumes has been shown to supply its nitrogen needs. Common bermudagrass establishment rate is good to moderate. Once established, bermudagrass can dominate a stand rapidly if supplemented with nitrogen fertilization. Its principle use in seeding mixtures for soil erosion control is for rapid establishment and persistant growth under sustained nitrogen fertilization.

Bahiagrass:

Bahiagrass is a perennial warm season species adapted to the warm humid region of the United States. Its northern boundaries of adaptation approaches the northern boarders of Mississippi. Bahiagrass shows superior drought and heat tolerance and low fertility requirements. Bahiagrass seed is widely distributed and contains a high percentage of hard coated seed. Because of this high proportion of hard coated seed, bahiagrass seed is often mechanically scarified to improve germination. Average germination time for bahiagrass is 12-14 days. Bahiagrass tolerates mildly acid soils with a soil reaction of 5.0 and responds to lime applied to soil at pH values equal to or less than 5.5. Bahiagrass nitrogen requirements are low, however, it will respond to supplemental nitrogen fertilization. Bahiagrass is well suited for mixing with legumes and thrives on nitrogen release from associated legumes. Bahiagrass establishment rate is slow. Once established, bahiagrass spreads slowly by short rhizomes and stolons. Seed production from bahiagrass is prolific and will readily increase itself through natural reseeding. Its use for soil stabilization of distributed soils is based on its presistant growth, low

fertility requirements, and excellent drought tolerance.

Weeping lovegrass:

Weeping lovegrass is a perennial warm season grass used predominately in the Southwest United States. No improved varieties of weeping lovegrass exist, however, there are several other species within the lovegrass genus. Weeping lovegrass is well adapted to the Southeastern regions of the United States and found throughout Mississippi. Weeping lovegrass shows superior drought tolerance and fertility requirements. Seed of weeping lovegrass is widely available and germinates in 4-5 days. Vertical shoot growth and establishment rate of weeping lovegrass following germination is rapid. Weeping lovegrass tolerates mildly acid soils with a soil reaction of 5.0 and response to lime applied to soil at pH valves equal to or less than 5.5. Nitrogen requirement of weeping lovegrass is low, however, it will respond to supplemental nitrogen fertilization. Weeping lovegrass mixes well with legumes species and can sustain its nitrogen needs from legume association. Excessive seeding rates of weeping lovegrass have been shown to inhibit other slower establishing species due to its highly competitive nature. Weeping lovegrass spreads by tillering and is classified as a bunch-type grass. Shoot growth of weeping lovegrass reaches 2-3 feet in height and can shade other species if its density is high. The principle use of weeping lovegrass in seed mixtures is for immediate slope stabilization due to its rapid establishment rate. Overall, weeping lovegrass shows excellent drought tolerance and low fertility requirements.

Tall fescue:

Tall fescue is a cool season perennial grass used predominately throughout the cool humid and northern boundaries of the warm humid regions of the United States. Tall fescue is the most widely adapted cool season grass which has been shown to persist as a perennial in Mississippi. Kentucky 31 is the most widely used cultivar of tall fescue for soil stabilization. Tall fescue compared to other cool season grasses shows superior drought tolerance and low fertility requirements. Germination time for tall fescue is 5-7 and it shows a good to moderate rate of establishment. Tall fescue tolerates acid soils down to a pH of 5.0 and responds to lime applied to the soil at pH values equal to or less than 5.5. Tall fescue has a low fertility requirement and responds well to nitrogen fertilization. Compatibility of tall fescue and legumes is good and nitrogen release from associated legumes allows it to thrive. Vegetative spreading of tall fescue is by short rhizomes and tillers. In nature, tall fescue spreads rapidly by reseeding and seed production is good. As a fall seeded species in northern Mississippi, tall fescue is used for soil stabilization due to its moderately rapid rate of establishment, good drought tolerance and low fertility requirements.

Annual Ryegrass:

Annual ryegrass is an annual or short lived perennial cool season grass used throughout most regions of the United States. Its use for soil stabilization is for rapid establishment and temporary cover. It germinates in 4-5 days and has a rapid rate of establishment following germination. Annual ryegrass seed is widely available and common or domestic annual ryegrass is used

predominately for soil erosion control. Reseeding capacity of annual ryegrass is good if seed head development is allowed to occur in nature. Annual ryegrass is best suited to fall or early winter seeding and shows a relatively low soil temperature tolerance for seed germination. The major uses of annual ryegrass for soil stabilization on distributed soil is for rapid soil stabilization and temporary cover.

Rye:

Rye is a cool season annual grass. Its use for soil stabilization is for rapid soil stability and temporary cover. Its germination period is 4-5 days and establishment following germination is rapid. Rye seed is widely available and a number of cultivars are available. All cultivars of rye were developed for rye grain production and its use for soil stabilization is secondary. Reseeding of rye will occur to a limited degree if seed head production is allowed. Rye is best suited for fall or early winter seeding. Minimum soil temperature requirements for rye germination has been shown to be lower compared to most other cool season grasses. The major use of rye for soil stabilization on distributed soils is for rapid soil stabilization and temporary cover.

Cool and Warm Season Legumes:

The major use of legumes for soil stabilization of distributed soils is for the release of nitrogen to associate plants. Although legumes themselves contribute to the overall stabilization of distributed soils, germination time is slow and establishment rate is less compared to most grass species used for soil erosion control. All legumes require symbiotic association with

Rhizobium for nitrogen fixation to occur. Although native soils contain natural populations of *Rhizobium* for legumes, innoculation of seed prior to sowing with commercially produced *Rhizobium* is required to insure vigorous establishment and persistence. N_2 fixation capacity of legume species is estimated between 80-240 lbs. nitrogen per acre. This nitrogen production by legumes is made available to associated plants by root and shoot decomposition as well as nitrogen leakage from intact nodules on roots.

Overall, the majority of legumes have a higher pH requirement (6.0-7.0) for persistent growth compared to most grasses used for soil erosion control. Several legume species, however, do show good acid soil tolerance and includes sericea lespedeza and subclover. Ready availability of essential nutrients are required for legume growth and reproduction, however, supplemental nitrogen fertilization of established legumes has been shown to be deleterious to legume persistence and N_2 fixation capacity.

Numerous legume species are well adapted to northern Mississippi. The legume species used in the research conducted here included red, white, crimson and subterrannean clovers, hairy vetch and sericea lespedeza. Red and white clovers are classified as short-lived cool season perennials, however, their improved reseeding capabilities allow these species to persist as annuals in northern Mississippi. Crimson and subclovers are classified as cool season annuals and both have been shown to persist over an extended period of years. Crimson clover is currently the most widely distributed cool season legume used to stabilize distributed soils in northern Mississippi. Its persistence as observed on

roadsides has exceeded 20 years in some locations. Hairy vetch is also a cool season annual which is shown to persist in northern Mississippi. Its principle use has been as a soil conditioner and forage. Sericea lespedeza is a warm season perennial legume which shows prolific seed production. Sericea lespedeza is a well adaptive legume used for stabilizing distributed soils. Its excellent tolerance to acidic soils as well as superior drought tolerance makes sericea lespedeza a hardy legume.

All cool season legumes are best seeded in the fall, whereas, warm season species are planted primarily in the early spring. Establishment of legumes has been successful as either an over-seeding into an existing vegetative stand or direct seeding into a newly prepared seedbed.

SEEDBED, SEEDING AND MULCHES

Creating a suitable seedbed which provides conditions for rapid seed germination and seedling establishment as well as limited soil erosion is required to achieve a stabilized and persistent vegetative stand. Preplant fertilizer and lime incorporation is essential to insure adequate and available nutrients and favorable soil reaction. Fertilizer incorporation can be achieved using numerous pieces of cultivation equipment. Incorporation should be relatively deep (10-14") and the soil surface left in as rough a condition as possible following incorporation. In the following research, preplant lime and fertilizer incorporation was based on a soil analysis[1] and incorporation was performed with

[1] Soil analyses were conducted by the Mississippi Cooperative Extension Service Soil Testing Laboratory and P, K, pH and lime requirements determined.

a weighted disc or spring tooth renovator.

Seed application was accomplished using a surface broadcast of dry seed or hydroseeding using a seed-water slurry. Compacting the soil surface following a surface application of seed was accomplished by using a cultipacker to insure good soil-seed contact. Mulch application following seeding was used to hasten seed germination by maintaining moisture near the seed and reducing soil erosion by slowing the velocity of water runoff and protecting the surface from rain impact. Straw (2 tons/acre) plus asphalt tact (100 gals/acres) mulch was used for all establishment studies conducted except those where mulch evaluations themselves were part of the study's objectives.

FIELD PLOT LOCATION

All research plots were located on slope or spoil areas in Tishomingo County, MS. Field plot locations were selected based on their representation of slope or spoil area and soil characteristics representative of the Tenn-Tom Waterway-Divide Section. Soil chemical and physical analyses were conducted on soil from plot areas prior to the initiation of all studies.

Two site locations of field plots were used. One site was located approximately 3 miles south of the Yellow Creek Port along an embankment of an IC&G railroad spurline (Yellow Creek Port Site). The other site was along or adjacent the Tenn-Tom Waterway located between Paden and Holcutt, MS (Tenn-Tom Waterway Site). The plot area on the Tenn-Tom Waterway Sites were permanent slopes or spoils selected as they were developed and made available through the U. S. Army Corps of Engineers. Plot area at the

Yellow Creek Port Site consisted of area located on east and west facing slopes encompassing approximately 2.5 acres. This site was developed by clearing previously established vegetation using a dragline located at the top of the slope (figure 1). Approximately 10-12 inches of surface soil plus vegetation was removed and stock piled. Each slope surface was disced horizontally across the slope following clearing to remove vertical grooves left by the dragline (figure 1). A diversion ditch was cut along the top of both slope exposures to prevent runoff of surface water onto the slope surfaces (figure 2). Plot area not immediately used was covered with 6 ml polyethylene plastic to protect from soil erosion (figure 2). Immediately prior to initiation of later studies, the plastic was removed and preplant fertilizer (1000 lbs/A of 10-20-10) and lime (2 tons/A of agricultural grade lime) were imcorporated 10-14" deep.

All studies were installed during the 1st year (Nov. 1976 - June 1978) on slope and spoil areas at the Yellow Creek Port Site. Later studies were installed at the Tenn-Tom Waterway Sites during the remaining 3 years (July 1978 - Nov. 1980).

FIELD PLOT MEASUREMENTS AND INSTALLATION

All measurements and data were collected at scheduled sequences to evaluate immediate and long term effects of treatments. Visual measurements were used to record treatment effects and included estimates of species composition, % cover and soil erosion. Species composition was estimated on a % composition of each species within a given area (60 cm^2). The % cover was based on % of living vegetation covering the plot area. Soil erosion was rated based

on a scale of none, slight, moderate and severe erosion. Soil erosion rated as moderate or severe was considered unacceptable. Quantitative measurements of an established stand were also taken. These measurements included sampling of a 60 cm^2 area and collecting plant height, density, and biomass of roots and shoots. Both visual and quantitative measurements were taken on each study.

All research studies were divided into establishment or maintenance investigations. Establishment studies included species selection, seeding rate evaluations, and mulch performances on newly prepared seedbeds. Maintenance studies included refertilization with nitrogen, phosphorus and/or potassium or overseeding into established vegetative stands. Overseeding involved the seeding of a legume and/or grass species into an established vegetative stand as a means of introducing or increasing the density of a given species. Seedbed preparation prior to overseeding included light discing or use of a clod-buster[1]. Refertilization was used to improve stand density and maintain slope stabilization prior to overseeding or implementation of other cultural practices to improve slope stabilization.

All materials used in these studies were of commercial agricultural grade. Fertilizers and lime were purchased locally from farm supplies. Seed was certified and applied separately or mixed immediately prior to seeding. All legume seed was inoculate with appropriate commercially available rhizobium at 2 times the recommended rate. All legume seeds were pretreated with a

[1] See Overseeding Study V for detail description of a clod-buster.

commercial sticker to insure good seed-inoculum contact.

Rainfall and temperature data was collected adjacent to the plot areas using a 30 day recording rainfall and temperature recorder.

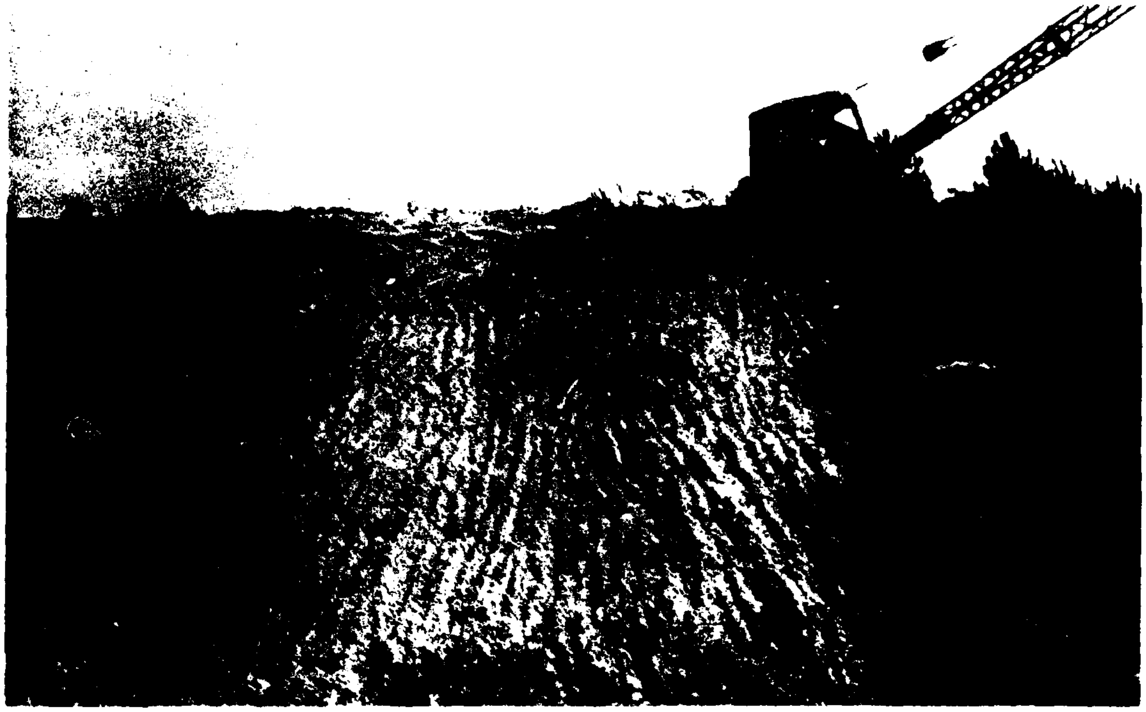

Figure 1. Plot development on the Yellow Creek Port Site. (Top) Slope area required excavation of the top 10-12" of soil plus plant material using a dragline. (Bottom) Slope area was cultivated horizontally across the entire plot surface using a weight disc to remove vertical grooves created by the dragline.

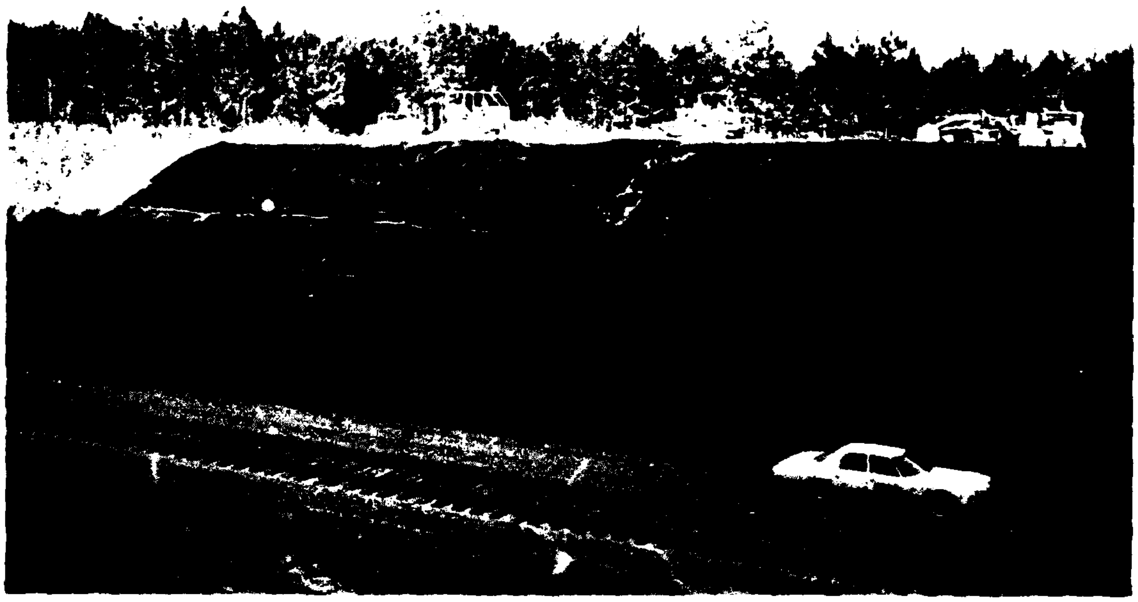

Figure 2. Plot development at the Yellow Creek Port Site. (Top) A diversion ditch was cut along the top of both slopes to prevent surface water runoff onto the slope surface. (Bottom) Immediately following clearing and cultivation, 6 mil polyethylene plastic was placed over plot area not immediately utilized as plot area to prevent soil erosion prior to future installations of plots.

Establishment Study I - 1976

The Establishment Study I - 1976 was initiated on November 5, 1976 on plot area located at the Yellow Creek Port Site on a 2H:IV east and west slope exposure.

Plant species used in this study were tall fescue (*Festuca arundinacea* cv. Kentucky 31); bahiagrass (*Paspalum notatum* cv. Pensacola); weeping lovegrass (*Eragrostis curvulus*); sericea lespedeza (*Lespedeza cuneata* cv. Interstate); common bermudagrass (*Cynodon dactylon*); annual ryegrass (*Lolium multiflorum*); and, rye (*Secale cereale* cv. Wrens).

Treatment combinations used in this study included the following:

Treatment 1 - Tall fescue (60 lbs/A); Bahiagrass (50 lbs/A); Weeping lovegrass (20 lbs/A); Sericea lespedeza (40 lbs/A); Common bermudagrass (20 lbs/A).

Treatment 2 - Annual ryegrass (60 lbs/A); Bahiagrass (50 lbs/A); Weeping lovegrass (20 lbs/A); Common bermudagrass (20 lbs/A).

Treatment 3 - Rye (120 lbs/A); Bahiagrass (50 lbs/A); Weeping lovegrass (20 lbs/A); Sericea lespedeza (40 lbs/A); Common bermudagrass (20 lbs/A).

This study was designed to evaluate fall seed germination and rate of seedling establishment of tall fescue, annual ryegrass and rye and spring establishment of dormant seeded bahiagrass, weeping lovegrass, sericea lespedeza and common bermudagrass as related to soil erosion control. The inclusion of warm season species was designed to evaluate the adaptation of these species to dormant seeding.

Dormant seeding is the practice of seeding a plant species during a time period not immediately conducive to germination. Germination occurs when natural changes in climatic conditions result in environmental condition favorable for germination. The Nov. 5, 1976 seeding date was selected for seeding in order to evaluate seed germination and establishment of 3 cool season grasses and dormant seeding of warm season species under conditions that would allow evaluation of both late fall establishment and dormant seeding.

Soil analysis and soil particle size distribution results of soil representative of the plot area are presented in table 1.

Table 1. Soil particle size distribution, phosphorus potassium, pH and lime requirement of soil representative of Establishment Study I - 1976 located at the Yellow Creek Port Site in Tishomingo Co., MS.

Soil pH	Lime Requirement	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil particle distribution sand	silt	clay	Soil Classification
	--tons/A--	--lbs/A--	--lbs/A--		%		
5.1	1.5	30	168	70	20	10	Sandy loam

A completely randomized block design was used and all treatments on the east and west slope exposure were replicated 3 times (figure 3). Plot dimensions were 10' x 60' and total plot area for both slopes was 10,800 sq. ft. All plots were seeded using a hand operated cyclone seeder and mulched with 2 tons straw and 100 gallons EA-4 asphalt per acre. Lime and fertilizer were derived from an agricultural source of limestone applied at 2 tons/A and a 10-20-10 agricultural grade fertilizer applied at 1 ton/A, respectively. Lime and fertilizer were immediately incorporated using a weighted

disc pulled horizontally across the slope surface.

An initial observation 13 days following seeding was made on November 18, 1976. No noticeable seed germination was observed across all plots. Rainfall during this period showed .13 inches of rain on November 11 followed by .20 inches on November 14. The average minimum low atmospheric temperature from the date of planting until the first observation was 30°F, while the average maximum atmospheric temperature was 58°F. Cool season grasses show optimum germination at average atmospheric temperature of 65-75°F. The below optimum temperatures and low soil moisture during the 13 day period prior to this observation is attributed for the delay in germination. Soil erosion was not noticeable during this period across all plots.

A second observation of the plot area was made December 2, 1976. The rye treatment showed noticeable germination on the east and west slope exposures (table 2, figure 4). Rye was the only species to germinate and establishment was restricted to an area directly above a seepage area and extending part way across the plot area. A visual examination under the straw mulch was made on the annual ryegrass and tall fescue plots to check for germination. Seeds were intact and appeared swollen with some seeds showing extension of the primary roots. The average low temperature between the November 18 (1st observation) and December 2 (2nd observation) was 30°F. The slopes received .18 inches of rain November 20, .85 inches on the 26th, .80 inches on the 28th, and .05 inches on the 29th of November. Sufficient moisture was available for germination during this time period, however, the

atmospheric temperatures were below optimum for germination of cool season grasses.

A third observation was made December 16, 1976. Conditions on the slopes were much the same as those observed December 2. No seedling emergence was observed on the annual ryegrass and tall fescue plots. The rye plots on both slope exposures showed greater germination compared to the December 2 (2nd observation) date. Seedling height of rye ranged from 1/4 to 1/2". Atmospheric temperatures between the 2nd (December 2) and 3rd (December 16) observations remained well below levels optimum for seed germination of the cool season grasses. Rainfall was less than 1" for this two week period.

On January 6, 1977 a 4th observation was made which showed increased seedling height (3-4") of rye plots. Annual ryegrass and tall fescue plots did not show signs of germination. Significant soil erosion was beginning to be noticeable on the annual ryegrass and tall fescue plots (table 2). The straw mulch on the rye plots was held relatively stable and soil erosion was minimal. The seedling heights for the rye plots on the west slope exposure were higher than those on the east slope exposure. This difference in plant height may be attributed to higher soil temperatures on the west compared to the east slope exposures due to the angle of solar radiation at this season of the year.

A 4th observation on February 10, 1977 showed little change in seed germination and seedling height across all plots. The annual ryegrass and tall fescue treatments showed no germination. Visual inspection of these seeds under the mulch revealed

germinated seeds with only a small part of their coleoptiles and primary roots emerged. Seeds not germinated were light colored and did not show visual signs of rotting or loss of viability.

Observations made on February 22 showed noticeable quantities of the mulch present on the annual ryegrass and tall fescue plots had moved to the toe of the slope due to erosion (table 2). Soil erosion on the plots surface for these treatments was rated as severe. The rye plots where the seedlings had established and the mulch was still intact showed little soil erosion on the plot surface.

Observations of the degree of cool season germination and seedling establishment were concluded following the February 22 observation.

The effects of dormant seed warm season species were evaluated during 2 observations. The first observation was made June 2, 1977. Annual ryegrass and tall fescue plots showed noticeable germination of sericea lespedeza and weeping lovegrass. Annual ryegrass germination was also evident on those seeded plots, however, the extent of establishment was slight. No tall fescue established in the spring. Rye plots showed limited germination of weeping lovegrass and sericea lespedeza. Soil erosion was severe on both the annual ryegrass and tall fescue plots due to winter erosion when the plots were unprotected. The rye plots showed rye growth to be 2-3 ft. tall with seed heads. Soil erosion on these plots was minimal. The greater establishment of sericea lespedeza and weeping lovegrass on the annual ryegrass and tall fescue plots compared

to the rye plots is attributed to greater competition due to the rye establishment in the fall compared to the other plots.

Observations on August 2, 1977 showed weeping lovegrass and sericea lespedeza as the only warm season species established from the dormant seeding. Greater density of these two warm season species were again observed on the annual ryegrass and tall fescue plots compared to the rye plots. The rye stubble was still intact at the time of this observation and was inhibiting germination of the dormant seed species. Soil erosion was similar to the observations made on June 2, 1977 and no noticeable signs of recent (3-4 months) erosion was visible. East and west slope exposures were relatively similar in % cover of the dormant seeded sericea lespedeza and weeping lovegrass and degree of soil erosion for the rye plots. Annual ryegrass and tall fescue plot area on the east slope exposure showed a lesser degree of soil erosion and greater cover of sericea lespedeza and weeping lovegrass compared to the west slope. This difference was most noticeable on plots which were intercepted by a seepage area located on the east slope. Species composition measurements continued to show weeping lovegrass cover greater compared to sericea lespedeza cover on the west slope across all plot area. This difference was not as noticeable on the east slope across all plot area. The cause of this difference in east and west slope exposures may be attributed in part to differential in soil temperatures and/or moisture supply.

Summary:

Rye plots were the only treatment to show noticeable germination

and only slight soil erosion. The lack of annual ryegrass and tall fescue germination is attributed to the below optimal atmospheric temperature following seeding. Seedling germination of the rye significantly reduced soil erosion. Plots without seedling establishment, as shown in the annual ryegrass and tall fescue plots, showed only limited and temporary soil erosion control from a straw-asphalt mulch.

Dormant seeding was shown to be applicable to sericea lespedeza and weeping lovegrass. Bahiagrass and common bermudagrass did not show spring establishment. Although dormant seeding was successful for two species, soil erosion was severe on the annual ryegrass and tall fescue plots before dormant seeded species established. The rye plot showed good soil erosion control, however, dormant seed establishment of the sericea lespedeza and weeping lovegrass was poor.

TREATMENTS:

Treatment 1 (T1) - 'Kentucky 31' tall fescue (60 lbs/A); 'Pensacola' bahiagrass (50 lbs/A); Weeping lovegrass (20 lbs/A); 'Interstate' sericea lespedeza (40 lbs/A); and Common bermudagrass (20 lbs/A).

Treatment 2 (T2) - 'Gulf' annual ryegrass (60 lbs/A); 'Kentucky 31' tall fescue (60 lbs/A); 'Pensacola' bahiagrass (50 lbs/A); Weeping lovegrass (20 lbs/A); 'Interstate' sericea lespedeza (40 lbs/A); and Common bermudagrass (20 lbs/A).

Treatment 3 (T3) - 'Wrens' rye (120 lbs/A); 'Kentucky 31' tall fescue (60 lbs/A); 'Pensacola' bahiagrass (50 lbs/A); Weeping lovegrass (20 lbs/A); 'Interstate' sericea lespedeza (40 lbs/A); and Common bermudagrass (20 lbs/A).

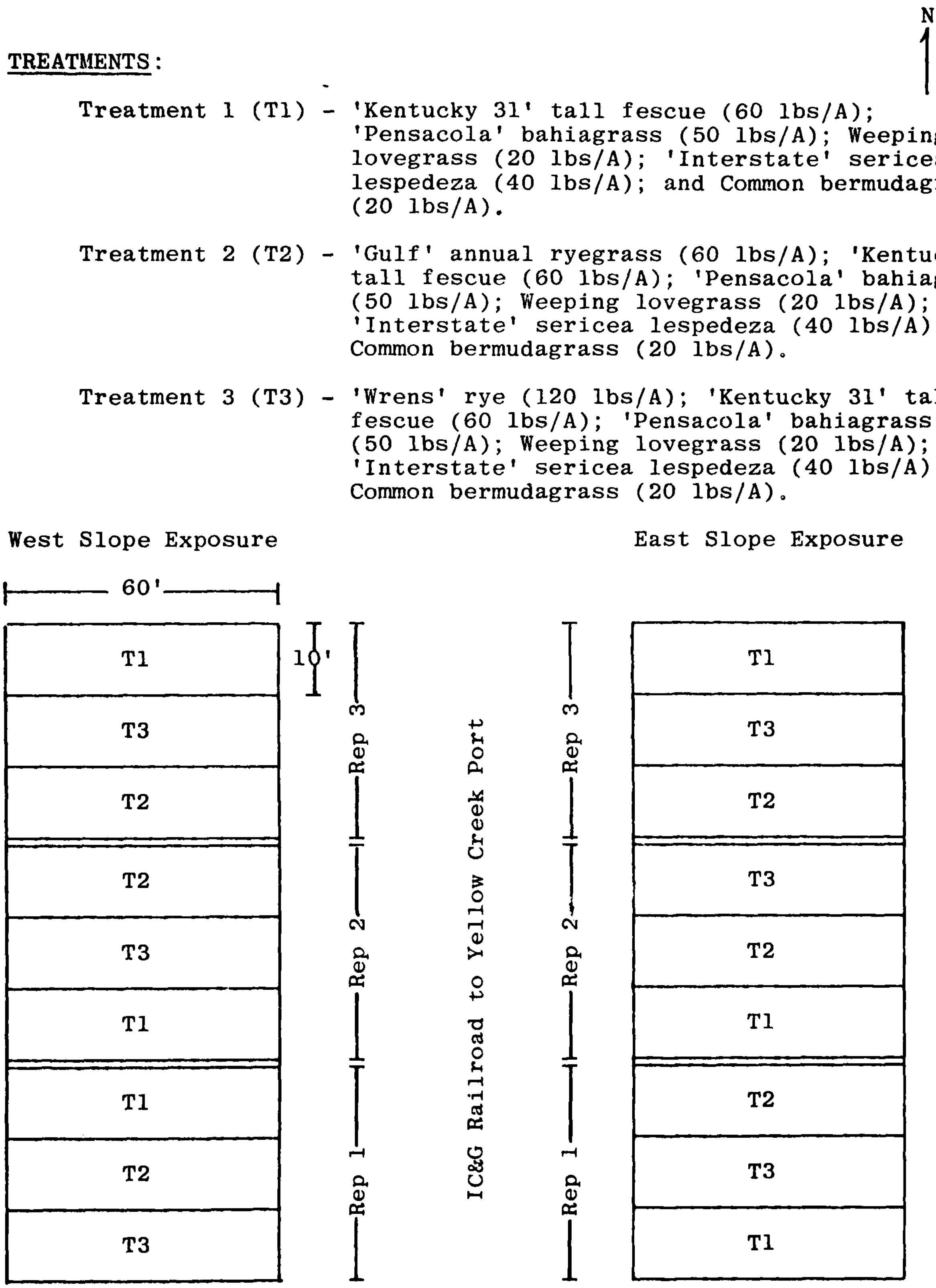

Figure 3: Field plot diagram of Establishment Study I - 1976 initiated Nov. 5, 1976 in a complet ly randomized block design located on a 2H:IV east ano est slope exposure at the Yellow Creek Port Site in Tishomingo Co., MS.

Table 2. The effects of selected cool and warm season species, and slope exposure on the species composition, % cover and soil erosion initiated Nov. 5, 1976 on a 2H:IV east and west slope exposure located at the Yellow Creek Site in Tishomingo Co., MS.

Observation Date	Slope Exposure	Seed Mix	Seeding Rate	Species Composition: tall fescue	annual ryegrass	rye	bahiagrass	weeping lovegrass	sericea lespedeza	common bermuda	% Cover	Soil Erosion
			--lbs/A--	%								
12-2-76	East	tall fescue	60	0	-†	-	0	0	0	0	0	slight
1-6-77		bahiagrass	50	0	-	-	0	0	0	0	0	moderate
2-22-77		weeping lovegrass	20	0	-	-	0	0	0	0	0	severe
6-2-77		sericea lespedeza	40	0	-	-	0	50	50	0	30	severe
8-2-77		common bermudagrass	20	0	-	-	0	45	55	0	45	severe
12-2-76		annual ryegrass	60	-	0	-	0	0	0	0	0	slight
1-6-77		bahiagrass	50	-	0	-	0	0	0	0	0	moderate
2-22-77		weeping lovegrass	20	-	0	-	0	0	0	0	0	severe
6-2-77		sericea lespedeza	40	-	20	-	0	60	20	0	60	severe
8-2-77		common bermudagrass	20	-	10	-	0	48	42	0	65	severe
12-2-76		rye	120	-	-	100	0	0	0	0	22	none
1-6-77		bahiagrass	50	-	-	100	0	0	0	0	28	none
2-22-77		weeping lovegrass	20	-	-	100	0	0	0	0	32	slight
6-2-77		sericea lespedeza	40	-	-	85	0	7	8	0	75	slight
8-2-77		common bermudagrass	0	-	-	70	0	15	15	0	70	slight
12-2-76	West	tall fescue	60	0	-	-	0	0	0	0	0	slight
1-6-77		bahiagrass	50	0	-	-	0	0	0	0	0	moderate
2-22-77		weeping lovegrass	20	0	-	-	0	0	0	0	0	severe
6-2-77		sericea lespedeza	40	0	-	-	0	75	25	0	35	severe
8-2-77		common bermudagrass	20	0	-	-	0	75	25	0	35	severe
12-2-76		annual ryegrass	60	0	0	-	0	0	0	0	0	slight
1-6-77		bahiagrass	50	-	0	-	0	0	0	0	0	moderate
2-22-77		weeping lovegrass	20	-	0	-	0	0	0	0	0	severe
6-2-77		sericea leapedeza	40	-	10	-	0	60	30	0	65	severe
8-2-77		common bermudagrass	20	-	10	-	0	60	30	0	50	severe
12-2-76		rye	120	-	-	100	0	0	0	0	30	none
1-6-77		bahiagrass	50	-	-	100	0	0	0	0	34	none
2-22-77		weeping lovegrass	20	-	-	100	0	0	0	0	36	slight
6-2-77		sericea lespedeza	40	-	-	90	0	5	5	0	70	slight
8-2-77		common bermudagrass	20	-	-	65	0	15	20	0	72	slight

† (-) denotes lack of species establishment due to treatment combination which did not include the plant species in the seed mix.

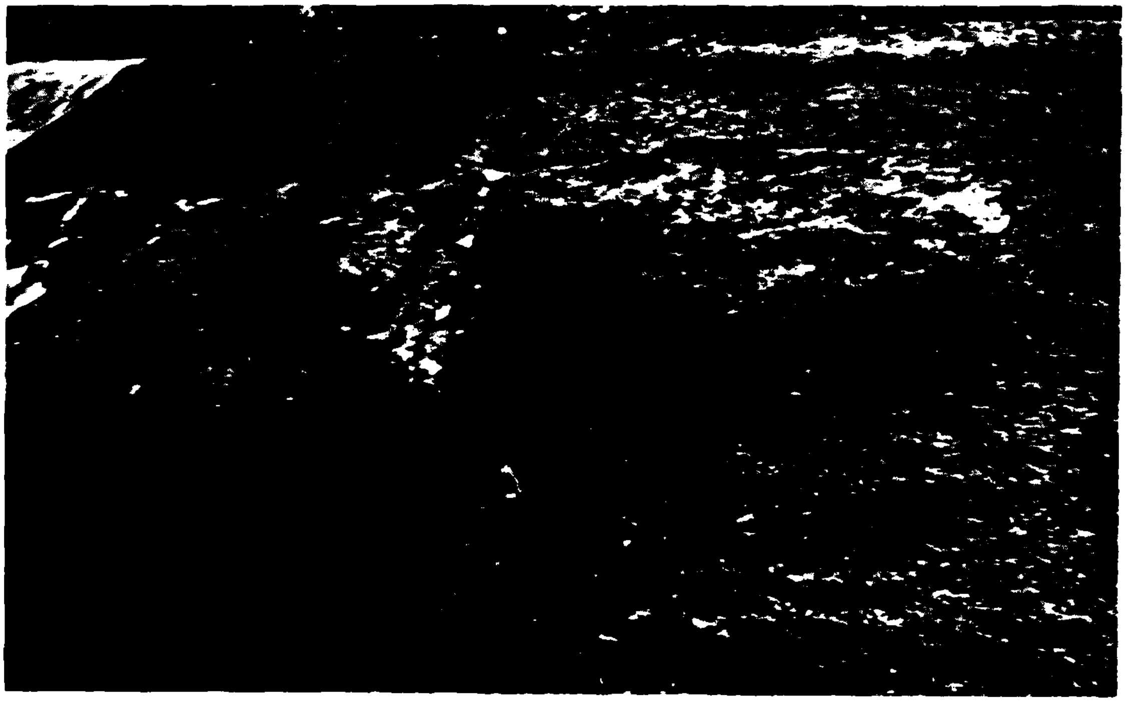

Figure 4. Plots representative of Establishment Study I - 1976 8 weeks after installation (Top) Plot area (R13E) seeded to rye showing good rye establishment and soil erosion control. (Bottom) Plot area seeded to annual ryegrass and tall fescue showing lack of seedling establishment and soil erosion evident by movement of the mulch down the slope

Establishment Study II - 1977

The Establishment Study II - 1977 was initiated February 21, 1977 on plot area located at the Yellow Creek Port Site on a 2H:IV east and west slope exposure.

Plant species used in this study were rye (Secala cereale cv. Wrens); bahiagrass (Paspalum notatum cv. Pensacola); weeping lovegrass (Eragrostis curvulus); sericea lespedeza (Lespedeza cuneata cv. Interstate); and common bermudagrass (Cynodon dactylon).

Treatment combination used in this study included the following:

Treatment 1 - Rye (120 lbs/A); bahiagrass (50 lbs/A); weeping lovegrass (20 lbs/A); sericea lespedeza (40 lbs/A); and common bermudagrass (20 lbs/A) mulched with 2 tons straw plus 100 gallons EA-4 asphalt per acre.

Treatment 2 - Bahiagrass (50 lbs/A); weeping lovegrass (20 lbs/A); sericea lespedeza (40 lbs/A); common bermudagrass (20 lbs/A) mulched with 4 tons straw plus 200 gallons EA-4 asphalt per acre.

Treatment 3 - Bahiagrass (50 lbs/A); weeping lovegrass (20 lbs/A); sericea lespedeza (40 lbs/A); common bermudagrass (20 lbs/A) mulched a nylon-paper webbed mulch (Hold-Gro[1]).

Treatment 4 - Rye (120 lbs/A) mulch with 2 tons straw plus 100 gallons EA-4 asphalt per acre.

Treatment 5 - Straw mulch at 4 tons straw plus 200 gallons EA-4 asphalt per acre without seed application.

[1] A product of Gulf States Paper Co., Inc., Tuscaloosa, Al.

Treatment 6 - A nylon-paper webbed without seed application

This study was designed to evaluate seed germination and seeding establishment of rye, a 2 and 4 tons/A straw-asphalt mulch, a nylon-paper webbed mulch, and dormant seeding of warm season species as related to soil erosion. The straw-asphalt and nylon-paper webbed mulches and rye plots were evaluated for temporary and immediate slope stabilization. Dormant seeding of the warm season species was evaluated to determine the successfulness of this practice for establishing a permanent cover in the spring. This study was initiated during mid-winter (February 21) when climatic conditions inhibit grass germination, yet stabilization of a disturbed soil may be required. Rye had been shown in the Establishment Study I - 1976 to tolerate lower temperature for germination compared to annual ryegrass and tall fescue. The straw plus asphalt mulches were selected because of wide-spread use and success for temporary soil erosion control as a seed mulch. The doubled rate of straw and asphalt (4 tons straw/acre plus 200 gallons EA-4 asphalt) was applied because of the 2 to 3 month protection needed prior to climatic condition adequate for dormant seed germination. The nylon-paper webbed mulch consisted of nylon netting with paper strips woven into the net. This mulch was tied to the soil surface with wire staples (6" in length) for securing the mulch to the soil surface. The nylon-paper webbing (10 ft. wide) was rolled downward and properly aligned. Staples were placed at two foot intervals along each side of the 10 foot paper strips. The inner area of the paper strip was stapled on three-foot centers. The upper end of the nylon-paper mulch was

secured by burying the end in a trench 2' deep.

Soil analyses results and particle size distribution of the plot area are presented in table 1. A completely randomized block design was used and all treatments on east and west slope exposures were replicated 3 times (figure 5). Plot size was 10' x 60' and total plot area was 21,600 sq. ft. Seed was applied using a hand operated cyclone seeder. The nylon-paper webbing mulch was installed and covered with plastic to prevent drift of straw and asphalt. The plastic covering used to protect the nylon-paper webbed mulch was removed following application of the straw-asphalt mulch.

An initial observation was made on February 25, 1977. Two days prior to this observation (February 23, 1977) the plot area received a rainfall of 1.5 inches in a 6 hr period. Both treatments with the straw-asphalt mulch (2 and 4 tons/A) were noticeably eroded and straw was washed to the toe of the slopes. The paper mulch was in tact, however, noticeable soil erosion had occurred under the mulch. Sediment which had eroded from the nylon-paper webbed mulch collected at the toe of the slope and formed a bulge under the mulch. A later observation on March 4, 1977 showed a lack of germination across all seeded plots (table 3). Severe soil erosion was evident across all plots.

Observations evaluating dormant seeding were made on June 2, 1977, August 2, 1977 and May 10, 1978 (table 3). The June 2, 1977 observation showed establishment of rye, weeping lovegrass and sericea lespedeza. Bahiagrass and common bermudagrass establishment was not noticeable. Rye establishment occurred in early spring (mid-May) and showed seed head development at the time of this observation.

The observations made June 2, 1977 and August 2, 1977 showed similar trends in species composition and % cover. Sericea lespedeza and weeping lovegrass establishment was greater and lesser, respectively, on the east slope exposure compared to the west slope exposure. The % cover was similar between all dormant seed plots on both east and west slope exposure except for those plots seeded with rye. Rye seeded plots showed greater % cover on both slope exposures compared to all other plots. An observation May 10, 1978 showed greater and lesser sericea lespedeza and weeping lovegrass, respectively, on the west compared to the east slope exposures. This trend is opposite to that measured in June and August 1977. The % cover of rye plots decreased and showed lowest density compared to all other plots. This measurement is also opposite from that recorded at the June and August 1977 observations.

Summary:

This study evaluated rye establishment, mulches, and dormant seeding of selected warm season species as related to soil erosion control. Rye plots failed to establish immediately following seeding. All plots suffered severe erosion due to the excessive

duration of exposure to rainfall. Dormant seeding was successful for sericea lespedeza and weeping lovegrass species, however, previous severe soil erosion limited the effectiveness of dormant seeding. Slopes exposure affected species composition and varied with the duration of the study and season.

Protecting slopes from soil erosion when exposed in mid-winter using mulches and/or seedling establishment was not possible. Dormant seeding was effective, however, slope erosion must be minimal prior to establishment in order for dormant seeding to be advantageous.

Table 3. The effects of rye, mulches and slope exposure on species composition, % cover and soil erosion seeded in mid-winter (Feb. 25) on a 2H:IV slope located at the Yellow Creek Port Site in Tishomingo Co., MS.

Observation Date	Mulch Treatment	Slope Exposure	Species Composition					% Cover	Soil Erosion
			Rye	Bahiagrass	Weeping lovegrass	Sericea lespedeza	Common bermuda		
			%						
	Rye (120 lbs/A)	East							
3-4-77	Bahiagrass (50 lbs/A)		0	0	0	0	0	0	severe
6-2-77	Weeping lovegrass (20 lbs/A)		55	0	30	15	0	45	severe
8-2-77	Sericea lespedeza (40 lbs/A)		55	0	28	17	0	49	severe
5-10-78	Common bermudagrass (20 lbs/A)		0	0	45	55	0	60	severe
	Mulched - 2 tons/A straw-asphalt								
3-4-77	Bahiagrass (50 lbs/A)		-†	0	0	0	0	0	severe
6-2-77	Weeping lovegrass (20 lbs/A)		-	0	65	35	0	51	severe
8-2-77	Sericea lespedeza (40 lbs/A)		-	0	68	32	0	54	severe
5-10-78	Common bermudagrass (20 lbs/A)		-	0	50	50	0	58	severe
	Mulched - 4 tons/A straw-asphalt								
3-4-77	Bahiagrass (50 lbs/A)		-	0	0	0	0	0	severe
6-2-77	Weeping lovegrass (20 lbs/A)		-	0	60	40	0	48	severe
8-2-77	Sericea lespedeza (40 lbs/A)		-	0	61	39	0	50	severe
5-10-78	Common bermudagrass (20 lbs/A)		-	0	53	47	0	57	severe
	Mulched - nylon-paper webbing								
	Rye (120 lbs/A)								
3-4-77	Bahiagrass (50 lbs/A)		0	-	-	-	-	0	severe
6-2-77	Weeping lovegrass (20 lbs/A)		100	-	-	-	-	62	severe
8-2-77	Sericea lespedeza (40 lbs/A)		100	-	-	-	-	65	severe
5-10-78	Common bermudagrass (20 lbs/A)		0	-	15	85	-	15	severe
	Mulched - 2 tons/A straw-asphalt								
3-4-77	Bahiagrass (50 lbs/A)		-	-	-	-	-	-	severe
6-2-77	Weeping lovegrass (20 lbs/A)		-	-	-	-	-	-	severe
8-2-77	Sericea lespedeza (40 lbs/A)		-	-	-	-	-	-	severe
5-10-78	Common bermudagrass (20 lbs/A)		-	-	15	85	-	20	severe
	Mulched - 4 tons/A straw-asphalt								
3-4-77	Bahiagrass (50 lbs/A)		-	-	-	-	-	-	severe
6-2-77	Weeping lovegrass (20 lbs/A)		-	-	-	-	-	-	severe
8-2-77	Sericea lespedeza (40 lbs/A)		-	-	-	-	-	-	severe
5-10-78	Common bermudagrass (20 lbs/A)		-	-	15	85	-	20	severe
	Mulched - nylon-paper webbing								

Table 3. (Cont.)

Table 3. (Cont.)

Observation Date	Mulch Treatment	Slope Exposure	Species Composition: Rye	Bahiagrass	Weeping lovegrass	Sericea lespedeza	Common bermuda	% Cover	Soil Erosion
			%						
	Rye (120 lbs/A)	West							
3-4-77	Bahiagrass (50 lbs/A)		0	0	0	0	0	0	severe
6-2-77	Weeping lovegrass (20 lbs/A)		50	0	40	10	0	48	severe
8-2-77	Sericea lespedeza (40 lbs/A)		49	0	42	9	0	51	severe
5-10-78	Common bermudagrass (20 lbs/A)		0	0	32	68	0	57	severe
	Mulched - 2 tons/A straw-asphalt								
3-4-77	Bahiagrass (50 lbs/A)		-	0	0	0	0	0	severe
6-2-77	Weeping lovegrass (20 lbs/A)		-	0	71	29	0	47	severe
8-2-77	Sericea lespedeza (40 lbs/A)		-	0	69	31	0	50	severe
5-10-78	Common bermudagrass (20 lbs/A)		-	0	42	58	0	65	severe
	Mulched - 4 tons/A straw-asphalt								
3-4-77	Bahiagrass (50 lbs/A)		-	0	0	0	0	0	severe
6-2-77	Weeping lovegrass (20 lbs/A)		-	0	68	32	0	45	severe
8-2-77	Sericea lespedeza (40 lbs/A)		-	0	65	35	0	50	severe
5-10-78	Common bermudagrass (20 lbs/A)		-	0	41	59	0	68	severe
	Mulched - nylon-paper webbing								
	Rye (120 lbs/A)								
3-4-77	Bahiagrass (50 lbs/A)		0	-	-	-	-	0	severe
6-2-77	Weeping lovegrass (20 lbs/A)		100	-	-	-	-	69	severe
8-2-77	Sericea lespedeza (40 lbs/A)		100	-	-	-	-	70	severe
5-10-78	Common bermudagrass (20 lbs/A)		0	-	15	85	-	12	severe
	Mulched - 2 tons/A straw-asphalt								
3-4-77	Bahiagrass (50 lbs/A)		-	-	-	-	-	-	severe
6-2-77	Weeping lovegrass (20 lbs/A)		-	-	-	-	-	-	severe
8-2-77	Sericea lespedeza (40 lbs/A)		-	-	-	-	-	-	severe
5-10-78	Common bermudagrass (20 lbs/A)		-	-	15	85	-	20	severe
	Mulched - 4 tons/A straw-asphalt								
3-4-77	Bahiagrass (50 lbs/A)		-	-	-	-	-	-	severe
6-2-77	Weeping lovegrass (20 lbs/A)		-	-	-	-	-	-	severe
8-2-77	Sericea lespedeza (40 lbs/A)		-	-	-	-	-	-	severe
5-10-78	Common bermudagrass (20 lbs/A)		-	-	15	85	-	20	severe
	Mulched - nylon-paper webbing								

† (-) denotes a lack of species establishment due to the absence of seed for that species in the seed mix.

N

TREATMENTS:

Treatment 1 (T1) - 'Wrens' rye (120 lbs/A); 'Pensacola' bahiagrass (50 lbs/A); Weeping lovegrass (20 lbs/A); 'Interstate' sericea lespedeza (40 lbs/a); and Common bermudagrass (20 lbs/A) mulched with 2 tons straw - 100 gal EA-4 asphalt/A.

Treatment 2 (T2) - 'Pensacola' bahiagrass (50 lbs/A); Weeping lovegrass (20 lbs/A); 'Interstate' sericea lespedeza (40 lbs/A); Common bermudagrass (20 lbs/A) mulched with 4 tons straw - 200 gal EA-4 asphalt/A.

Treatment 3 (T3) - 'Pensacola' bahiagrass (50 lbs/A); Weeping lovegrass (20 lbs/A); 'Interstate' sericea lespedeza (40 lbs/A); Common bermudagrass (20 lbs/A) mulched with nylon-paper webbing (Hold-Gro).

Treatment 4 (T4) - 'Wrens' rye (120 lbs/A) mulched with 2 tons straw - 100 gal EA-4 asphalt/A.

Treatment 5 (T5) - Mulched with 4 tons straw - 200 gal EA-4 asphalt/A

Treatment 6 (T6) - Mulched with nylon-paper webbing (Hold-Gro).

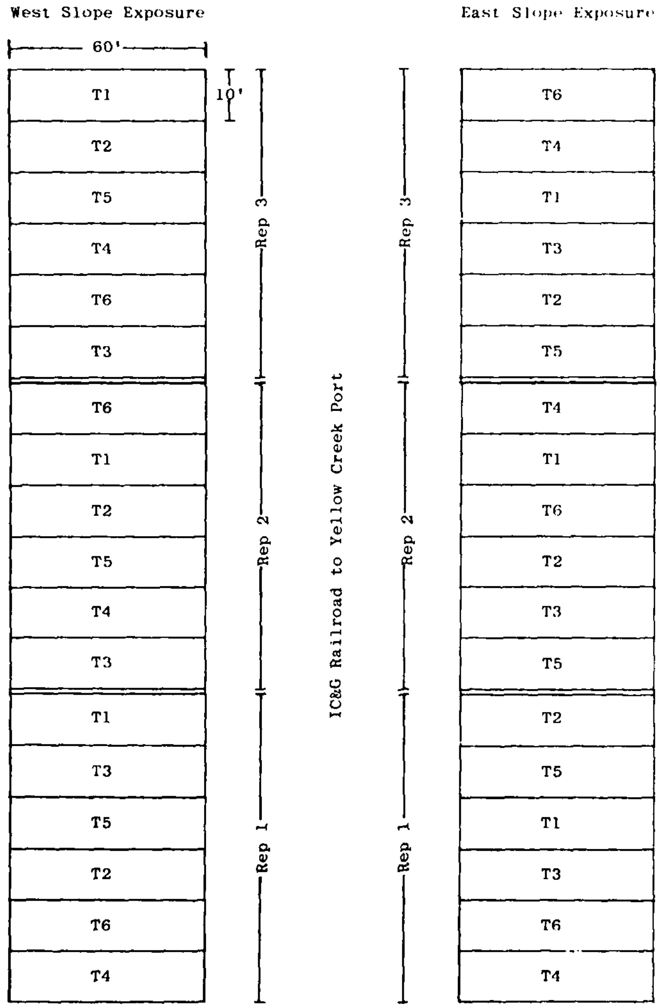

Figure 5: Field plot diagram of Establishment Study II - 1977 initiated February 22, 1977 in a completely randomized block design located on a 2H:IV east and west slope exposure at the Yellow Creek Port Site in Tishomingo Co., MS.

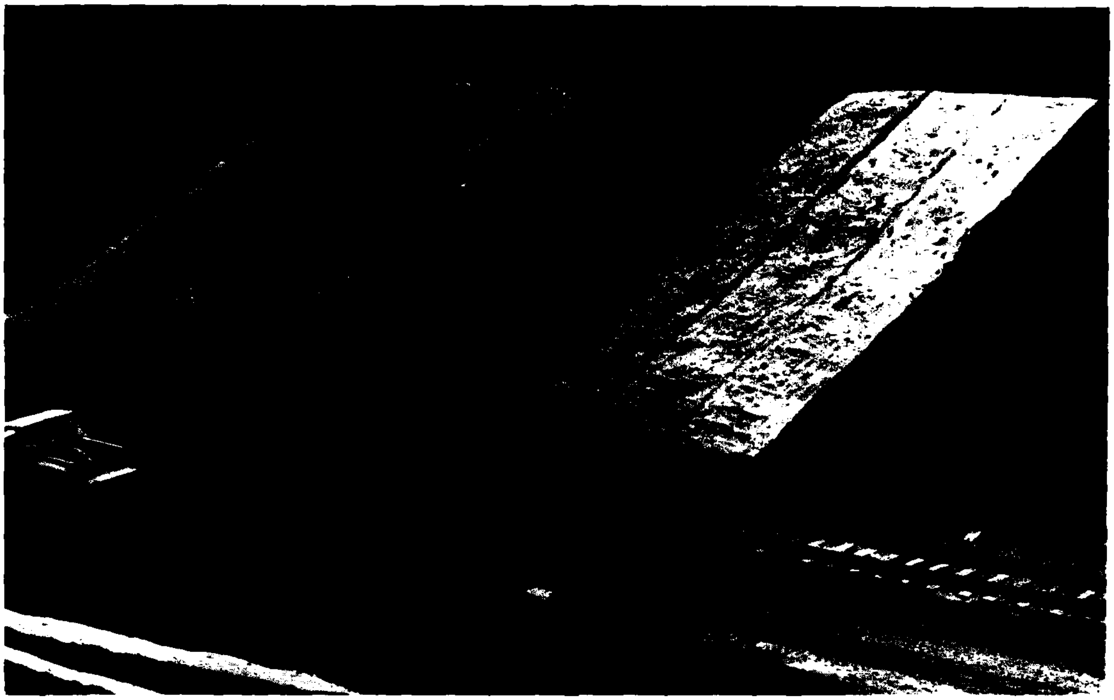

Figure 6. Plot area representative of Establishment Study II - 1977. (Top) Plot area showing installation of the nylon-paper webbed mulch. (Bottom) Plot area showing 4 tons/A straw-asphalt mulch + dormant seeding (left), nylon-paper webbed mulch + dormant seeding (center) and rye + dormant seeding (right) recorded August 2, 1977.

Establishment Study III - 1977

The Establishment Study III - 1977 was initiated on July 20, 1977 on plot area located at the Yellow Creek Port Site on a 2H:IV east and west slope exposures.

The plant species used in the study were weeping lovegrass (*Eragrostis curvulus*); common bermudagrass (*Cynodon dactylon*); (*Paspalum notatum* cv. 'Pensacola'); and sericea lespedeza (*Lespedeza cuneata*).

Treatment combinations used in this study included the following:

Treatment 1 - Common bermudagrass (20 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); 'Serala' sericea lespedeza (30 lbs/A); Weeping lovegrass (15 lbs/A)

Treatment 2 - Common bermudagrass (20 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); 'Serala' sericea lespedeza (30 lbs/A); Weeping lovegrass (30 lbs/A)

This study was designed to evaluate the competitiveness of weeping lovegrass seeded at two rates in combination with common bermudagrass, bahiagrass and sericea lespedeza and effects of east and west slope exposure on species germination, % cover and soil erosion. Weeping lovegrass establishes rapidly and forms a dense and competitive vegetative stand. This aggresive nature of weeping lovegrass can cause excessive competition with other more slowly establishing plants and can inhibit or retard their establishment.

Soil analysis results and particle size distribution of the

plot area are presented in table 1. A completely randomized block design was used and all treatments on east and west slope exposures were replicated 3 times. Plot size was 30 x 60 ft. and total plot area was 21,600 sq. ft. (figure 7). Plots were seeded with a hand operated cyclone seeder and mulched with 2 tons/acre straw-asphalt.

An initial observation on August 2, 1977 showed weeping lovegrass as the only species germinated (table 4). Weeping lovegrass emergence was greatest in the upper 1/3 of most plots. The 30 lbs/A seeding rate of weeping lovegrass showed similar establishment compared to the 15 lbs/A rate at this observation date. There was no difference in the effect of slope exposure on seedling emergence. Soil erosion was not noticeable and was similar across all plots.

A second observation on August 18, 1977 showed bermudagrass seed had germinated and composed 16-22% of the total cover across all treatments. No noticeable differences in weeping lovegrass establishment was measured at this observation date. The % cover for all plots was relatively similar with the 30 lbs/A rate of weeping lovegrass showing slightly greater % cover on the west slope facing compared to the east. Soil erosion was similar for all plots.

An observation on September 2, 1977 showed increased coverage across all plots. The highest % cover was observed on the west slope facing at the 30 lbs/A weeping lovegrass seeding rate. This species composition changed compared to the previous observation (August 18, 1977). Bermudagrass showed increased growth and

coverage compared to weeping lovegrass. Also noticed were seedlings of bahiagrass and sericea lespedeza on the west slope exposure. Soil erosion was similar across all plots.

An observation on May 10, 1978 showed a lack of spring regrowth of bermudagrass. Weeping lovegrass plants showed good spring regrowth and seedlings of sericea lespedeza were also noticeable. Soil erosion was similar across all plots.

A later observation on June 1, 1978 showed extensive winter-kill of bermudagrass which accounted for 40-50% lost in total cover. Weeping lovegrass and sericea lespedeza plants dominated the slopes with inclusions of bahiagrass. Soil erosion was similar across all plots. Total percent cover of the stand was slightly greater on the east compared to the west slope exposures.

<u>Summary</u>:

A comparison of seeding rates of weeping lovegrass (15 and 30 lbs/A) on a 2H:IV east and west slope exposure showed similar density of initial seedling establishment. The lowest seeding rate (15 lbs/A) of weeping lovegrass was excessive and resulted in initial inhibition of seedling establishment of other species. Weeping lovegrass was the first species to germinate followed by bermudagrass. Weeping lovegrass dominated the slope initially, however, bermudagrass density increased later. The west and east slope exposures showed relatively similar results, however, the west slope exposure did show slightly greater density and cover. Bermudagrass winter-kill occurred during the winter months of 1977-78. This resulted in a 40-50% loss in cover. Soil erosion was not effected by this winter kill and sericea lespedeza and

weeping lovegrass density was sufficient to maintain slope stabilization. Seeding rates less than 15 lbs/A weeping lovegrass and 20 lbs/A of common bermudagrass are required to reduce seedling competition and allow establishment of other more slowly establishing species. Future studies will investigate lower seeding rates of weeping lovegrass and common bermudagrass.

Table 4. The effects of seeding rate of weeping lovegrass and slope exposure on the % species composition and % cover initiated July 20, 1977 on a 2H:IV slope located at the Yellow Creek Port Site in Tishomingo Co., MS.

Seed mixture	Seeding rate	Slope exposure	Observation date	Species Composition: Weeping lovegrass	Species Composition: bermudagrass	Species Composition: bahiagrass	Species Composition: Sericea lespedeza	% cover	Soil Erosion
	—lbs/A—			%	%	%	%		
weeping lovegrass	15	east	8-2-77	100	0	0	0	36	none
bahiagrass	45		8-18-77	80	20	0	0	40	none
sericea lespedeza	30		9-2-77	58	40	0	0	77	none
bermudagrass	20		6-1-78	76	5	0	15	30	none
		west	8-2-77	100	0	0	0	30	none
			8-18-77	78	22	0	0	35	none
			9-2-77	53	45	2	0	80	none
			6-1-78	76	4	4	19	38	none
weeping lovegrass	30	east	8-2-77	100	0	0	0	30	none
bahiagrass	45		8-18-77	80	20	0	0	37	none
sericea lespedeza	30		9-2-77	65	35	0	0	72	none
bermudagrass	20		6-1-78	73	4	3	20	29	none
		west	8-2-77	100	0	0	0	40	none
			8-18-77	84	16	0	0	45	none
			9-2-77	42	55	3	0	86	none
			6-1-78	69	4	7	18	40	none

TREATMENTS:

Treatment 1 (T1) - Weeping lovegrass (15 lbs/A); Common bermudagrass (20 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and 'Serala' sericea lespedeza (30 lbs/A).

Treatment 2 (T2) - Weeping lovegrass (30 lbs/A); Common bermudagrass (20 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and 'Serala' sericea lespedeza (30 lbs/A).

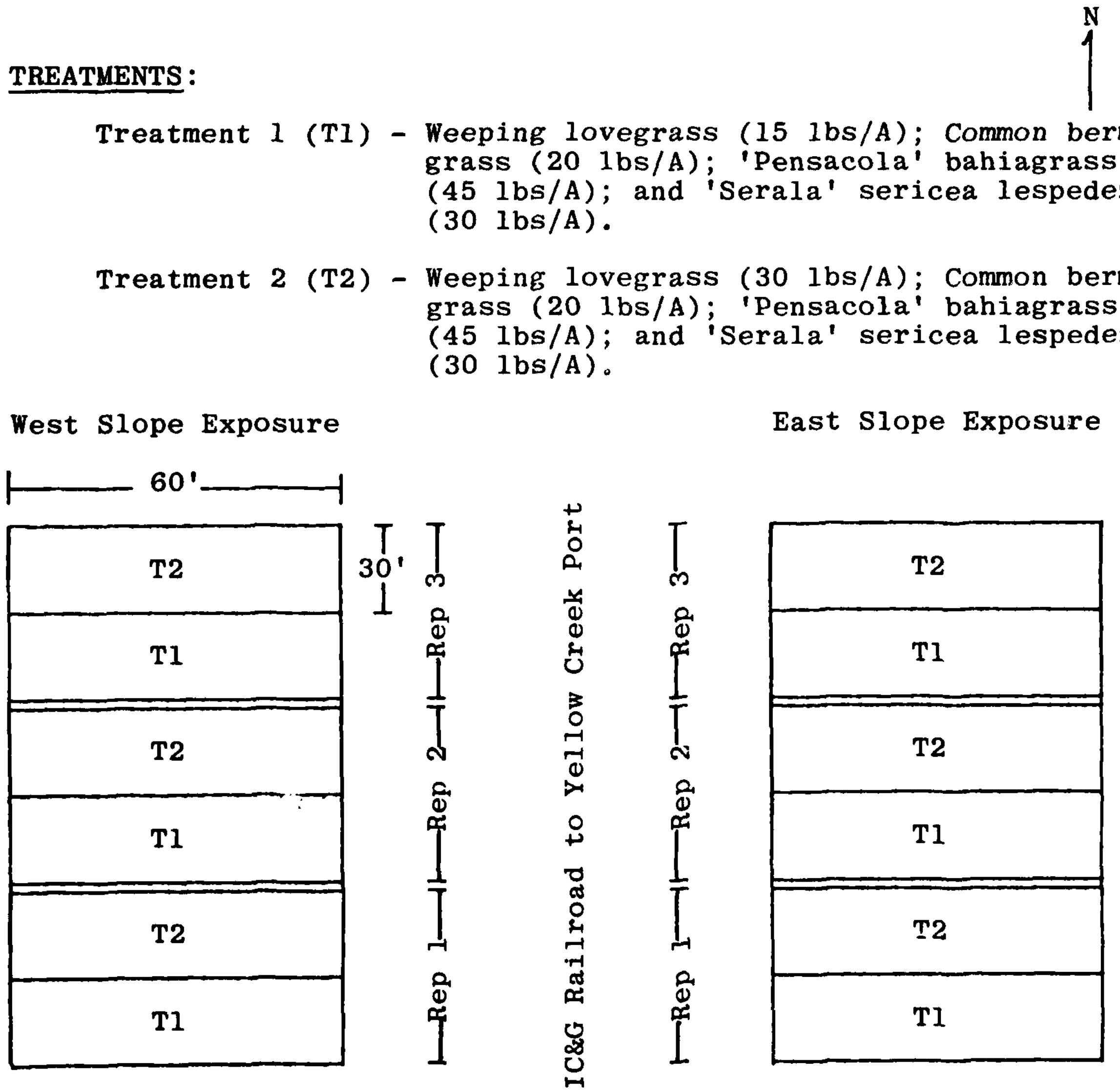

Figure 7: Field plot diagram of Establishment Study III- 1977 initiated July 20, 1977 in a completely randomized block design located on a 2H:IV east and west slope exposure at the Yellow Creek Port Site in Tishomingo Co., MS.

Figure 8 Plot area representative of Establishment Study III - 1977 (Top) Plot area (RIT2SS-WSF) showing good seedling establishment of weeping lovegrass and common bermudagrass seeded at 20 lbs/A common bermudagrass, 45 lbs/A bahiagrass, 30 lbs/A sericea lespedeza and 30 lbs/A weeping lovegrass recorded September 15, 1977. (Bottom) The same plot area as shown above showing winter-kill of common bermudagrass and survival of weeping lovegrass and sericea lespedeza recorded June 2, 1978

Establishment Study IV - 1977

The Establishment Study IV - 1977 was initiated July 20, 1977 on a plot area located at the Yellow Creek Port Site on a 10% slope surface (simulated spoil).

The plant species used in this study were weeping lovegrass (Eragrostis curvulus Schrad. Nees.); common bermudagrass (Cynodon dactylon L. Pers.); bahiagrass (Paspalum notatum Flugge cv. 'Pensacola'); and sericea lespedeza (Lespedeza cuneata cv. Serala).

The treatment combination evaluated in this study included the following:

Treatment 1 - Common bermudagrass (20 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); 'Serala' sericea lespedeza (30 lbs/A).

Treatment 2 - Common bermudagrass (20 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); 'Serala' sericea lespedeza (30 lbs/A); Weeping lovegrass (15 lbs/A).

This study was designed to evaluate weeping lovegrass within a seed mix of bahiagrass, common bermudagrass and sericea lespedeza on species competition, % cover and soil erosion. Weeping lovegrass is a grass species which can establish rapidly and easily dominate a stand. Its use in a seed mixture is for rapid establishment and immediate control of soil erosion. Weeping lovegrass is used most widely on steep slopes and/or highly erodable soils which require rapid seedling establishment. Weeping lovegrass was evaluated within a seed mix in this study for stabilizing spoil

areas in which slope steep is not critical. Soil analysis and soil particle size distribution results of soil representative of the plot area are presented in table 1. A completely randomized block design was used and all treatments replicated 3 times (figure 9). Plot dimensions were 25' x 30' and total plot area was 2250 sq. ft. All plots were seeded using a hand operated cyclone seeder and mulched with 2 tons straw and 100 gals EA-4 asphalt per acre.

An initial observation on August 2, 1977 showed germination of weeping lovegrass. Bermudagrass seed showed only limited germination. No other seed species showed emergence at the time of this observation.

An observation on August 18, 1977 showed increased bermudagrass establishment on plots with weeping lovegrass seed included. The % cover increased on all plots. Bahiagrass and sericea lespedeza did not show germination at the time of this observation.

An observation on September 2, 1977 showed an increase in the % composition of bermudagrass on plots seeded with weeping lovegrass. The % cover increased on all plots for both treatments. Establishment of bahiagrass and sericea lespedeza was slight at the time of this observation.

A spring observation on June 2, 1978 showed winter kill of bermudagrass across all plots. Most severe loss was recorded on plots seeded without weeping lovegrass which contained 90-95% bermudagrass cover. The % cover decreased on all plots due to the bermudagrass winter-kill. Bahiagrass and sericea lespedeza establishment increased compared to the September 2, 1977 observation.

Summary:

Plots seeded with weeping lovegrass dominated the stand initially. Bermudagrass established less rapidly, however, it increased following initial establishment. Bermudagrass seeded without weeping lovegrass dominated the cover in these plots. Both treatments tended to inhibit establishment of bahiagrass and sericea lespedeza. Winter-kill of bermudagrass resulted in reduced cover the following spring. Net loss of bermudagrass was estimated at 80-90%. Bahiagrass and sericea lespedeza establishment increased following reduction in competition due to winter-kill. Soil erosion was not evident on the plot area throughout the study. Loss of bermudagrass due to winter-kill did not affect soil erosion.

TREATMENTS:

Treatment 1 (T1) - Weeping lovegrass (15 lbs/A); common bermudagrass (20 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and 'Serala' sericea lespedeza (30 lbs/A).

Treatment 2 (T2) - common bermudagrass (20 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and 'Serala' sericea lespedeza (30 lbs/A).

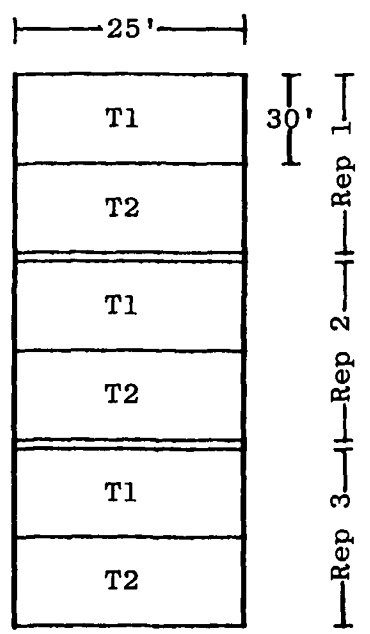

Figure 9: Field plot diagram of Establishment Study IV - 1977 initiated July 20, 1977 in a completely randomized block design located on a 10% slope surface at the Yellow Creek Port Site in Tishomingo Co., MS.

Table 5. The effects of weeping lovegrass in combination with selected warm season species on the species composition, % cover and soil erosion initiated July 20, 1977 on 10H:IV slope located at the Yellow Creek Port Site in Tishomingo Co., MS.

Seed mixture	Seeding rate	Observation date	Species Composition				% cover
			Weeping lovegrass	bermudagrass	bahiagrass	Sericea lespedeza	
	--lbs/A--						
weeping lovegrass	15	8-2-77	90	10	0	0	67
common bermudagrass	20	8-18-77	84	16	0	0	87
bahiagrass	45	9-2-77	61	35	2	2	90
sericea lespedeza	30	6-1-78	75	5	10	10	20
common bermudagrass	20	8-2-77	-	100	0	0	33
bahiagrass	45	8-18-77	-	100	0	0	60
sericea lespedeza	30	9-2-77	-	90	5	5	90
		6-1-78	-	45	20	35	5

(-) denotes lack of species composition due to absence of seed within seed mix.

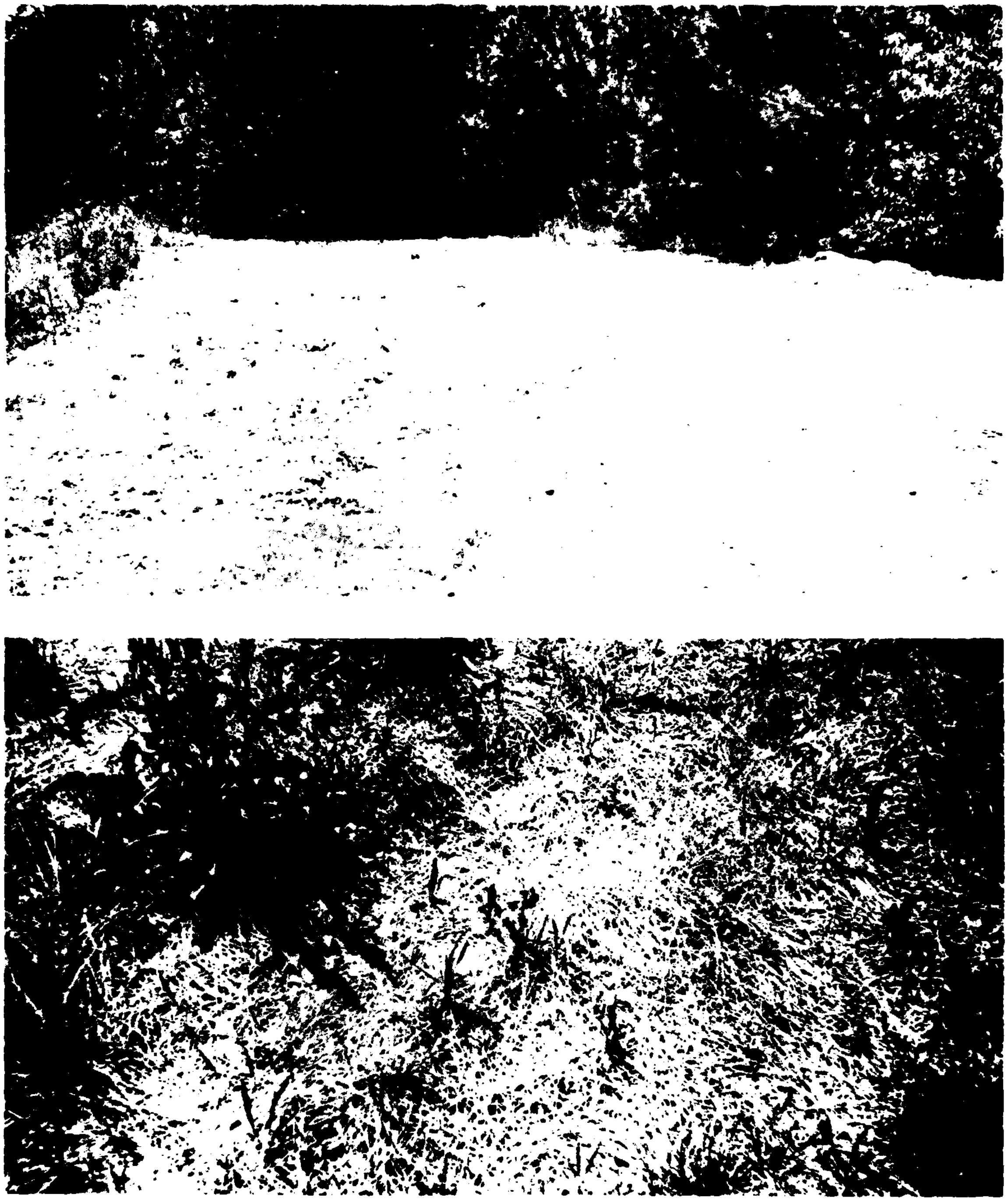

Figure 10. Plot area representation of Establishment Study IV - 1977. (Top) Seedling establishment of weeping lovegrass seeded at 20 lbs/A common bermudagrass, 45 lbs/A bahiagrass, 30 lbs/A sericea lespedeza and 15 lbs/A weeping lovegrass recorded August 2, 1978, 13 days after seeding. (Bottom) A portion of the above plot area showing winter-kill of the common bermudagrass and survival of weeping lovegrass recorded June 2, 1978.

Establishment Study V - 1977

The Establishment Study V - 1977 was initiated on October 31, 1977 on a plot area located at the Tenn-Tom Waterway Site (Test Trench) on a 2H:IV east slope exposure.

The plant species used in this study were white clover (*Trifolium repens* cv. 'Regal'); red clover (*T. pratense* cv. 'Kenland'); subclover (*T. subterraneum* cv. 'Mt. Barker'); crimson clover (*T. incarnatum* cv. 'Dixie'); and hairy vetch (*Vicia villosa*).

Treatment combinations used in this study included the following:

Treatment 1 - white clover (3 lbs/A)

Treatment 2 - red clover (10 lbs/A)

Treatment 3 - subclover (20 lbs/A)

Treatment 4 - crimson clover (30 lbs/A)

Treatment 5 - hairy vetch (30 lbs/A)

This study was designed to evaluate the establishment and persistence of 5 legume species seeded into an established stand of weeping lovegrass. These legume species were selected because of their proven adaptation to northern Mississippi under forage management systems. Legumes are used for soil stabilization because of the nitrogen release by legumes to associated plants. This nitrogen contribution is critical for long-term stabilization and persistence of a stabilizing vegetative cover.

Soil analysis results and particle size distribution of a soil sample representative of the plot area are presented in table 6.

Table 6. Soil particle size distribution, phosphorus, potassium, pH and lime requirements of a soil representative of Establishment Study V - 1977 located at the Tenn-Tom Waterway Site (Test Trench) on a 2H:IV east slope exposure in Tishomingo Co., MS.

Soil pH	Lime Requirement	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution sand	silt	clay	Soil textural Classification
	—tons/A—	———— lbs/A ————					
5.4	1.5	55(L)	109(L)	90.5	3.6	5.9	Sand

(L) denotes low availability of nutrient for plant growth and reproduction.

A completely randomized block design was used and all treatments were replicated 3 times. Plot size was 20' x 30' and total plot area was 9,000 sq. ft. (figure 11). Plots were seeded with a hand operated cyclone seeder. Each legume was inoculated with appropriate innoculum immediately prior to seeding. Species composition of the plot area prior to seeding was 100% weeping lovegrass and % cover was 60-70%.

An initial observation on September 5, 1979 showed establishment of all legume species. Crimson clover and hairy vetch showed greatest % cover (15 and 40%, respectively) (table 7).

An observation on May 10, 1978 showed greater establishment of crimson clover and hairy vetch compared to the other legumes following the overwintering period. Hairy vetch plots showed the greatest % cover (47%) followed by crimson clover (25%). Red clover, white clover, and subclover plots showed less but noticeable cover. Crimson clover was the only species flowering at the time of this observation.

On June 21, 1978 a third observation was made and showed increased cover for all legumes compared to the May 10, 1978 observation. Hairy vetch plots continued to show greatest cover

followed by crimson clover plots. Hairy vetch, white clover and red clover were flowering at the time of this observation.

A fourth observation was made on May 15, 1979 to evaluate reseeding capabilities of the legumes. Hairy vetch and crimson clover plots showed greater reseedling establishment compared to the other legumes. White clover, red clover and subclover plots showed equal or less cover compared to the degree of initial establishment.

Summary:

The crimson clover and hairy vetch plots showed greatest establishment and reseeding abilities compared to the other species evaluated. Based on these initial findings, hairy vetch and crimson clover appeared to be the most adaptive to the conditions of this test. Additional evaluation of these two legumes will be performed to further evaluate their use and adaptation.

Table 7. The % cover of legumes seeded into an established canopy of weeping lovegrass on October 31, 1977 located on a 2H:IV east slope exposure at the Tenn-Tom Waterway Site (Test Trench) in Tishomingo Co., MS.

Legume	Seeding rate	Observation date	% cover
	--lbs/A--		
White clover	3	9-5-77	4
		5-10-78	18
		6-21-78	15
		5-15-79	3
Red clover	10	9-5-77	8
		5-10-78	13
		6-21-78	20
		5-15-79	10
Subclover	20	9-5-77	3
		5-10-78	5
		6-21-78	5
		5-15-79	2
Crimson clover	30	9-5-77	15
		5-10-78	25
		6-21-78	30
		5-15-79	35
Hairy vetch	30	9-5-77	40
		5-10-78	47
		6-21-78	50
		5-15-79	45

TREATMENTS:
Treatment 1 (T1) 'Regal' white clover (3 lbs/A)
Treatment 2 (T2) 'Kenland' red clover (10 lbs/A)
Treatment 3 (T3) 'Mt. Barker' subclover (20 lbs/A)
Treatment 4 (T4) 'Dixie' crimson clover (30 lbs/A)
Treatment 5 (T5) Hairy vetch (30 lbs/A)

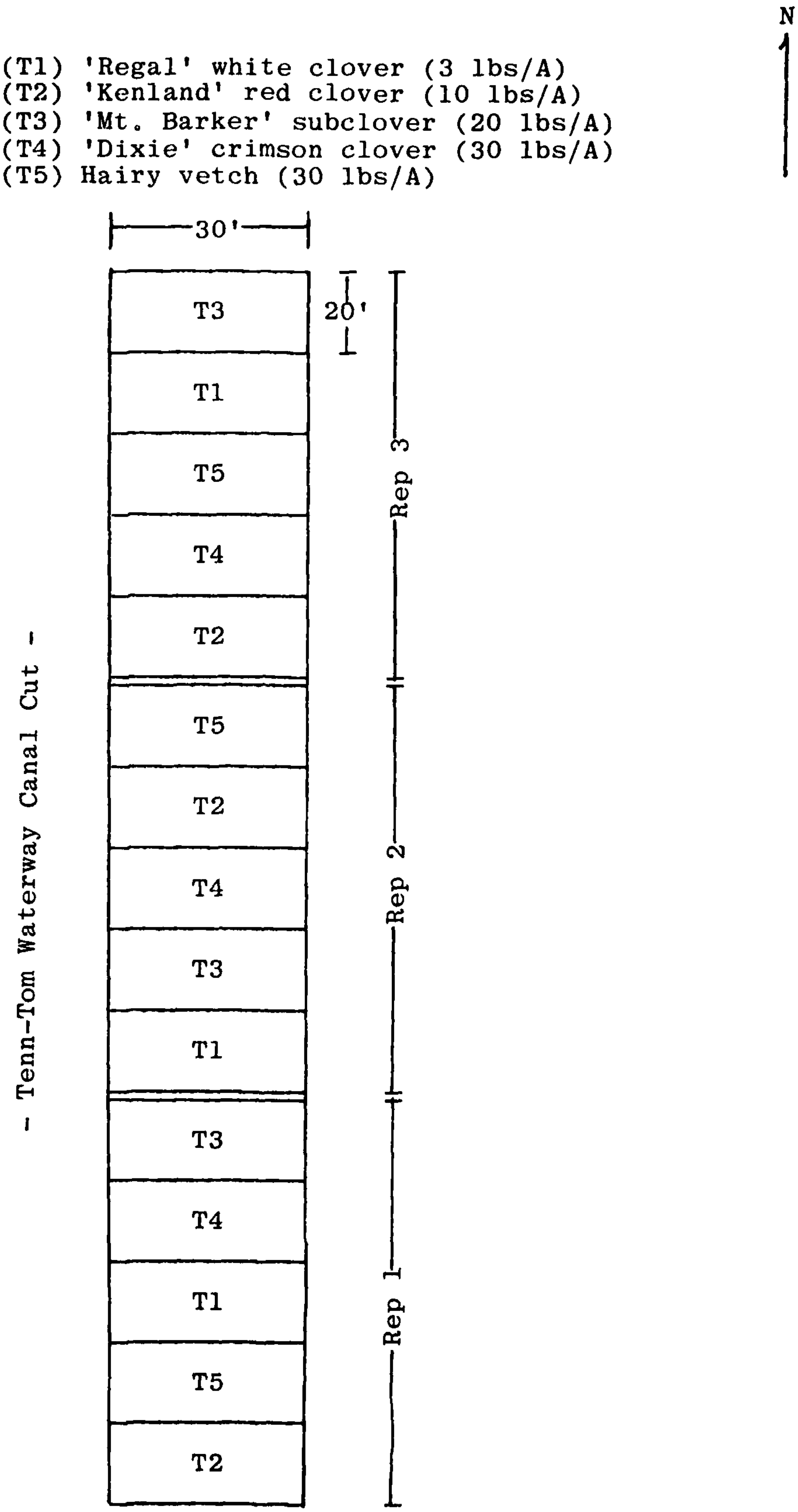

Figure 11: Field plot diagram of Establishment Study V - 1977 initiated October 31, 1977 in a completely randomized block design located on a 2H:IV east slope exposure at the Tenn-Tom Waterway Site (Test Trench) in Tishomingo Co., MS.

Figure 12. Plot area representative of Establishment Study V - 1978. Spring growth of hairy vetch established the previous fall and recorded June 10, 1979.

Establishment Study VI - 1978

The Establishment Study VI - 1978 was initiated on May 22, 1978 on plot area located at the Tenn-Tom Waterway Site (L&N railroad relocation 2 miles east of waterway canal) on a 2.5H:IV east slope exposure.

The plant species used in this study were weeping lovegrass (*Eragrostis curvula*); sericea lespedeza (*Lespedeza cuneata*); bahiagrass (*Paspalum notatum* cv. 'Pensacola'); and, common bermudagrass (*Cynodon dactylon*).

The treatment combinations used in this study included the following:

Treatment 1 - Weeping lovegrass (10 lbs/A); sericea lespedeza (30 lbs/A); bahiagrass (45 lbs/A); and, common bermudagrass (10 lbs/A) plus 3 tons/A preplant straw incorporated.

Treatment 2 - Weeping lovegrass (20 lbs/A); sericea lespedeza (30 lbs/A); bahiagrass (45 lbs/A); and, common bermudagrass (10 lbs/A) plus 3 tons/A preplant straw incorporated.

Treatment 3 - Weeping lovegrass (10 lbs/A); sericea lespedeza (30 lbs/A); bahiagrass (45 lbs/A); and, common bermudagrass (10 lbs/A).

Treatment 4 - Weeping lovegrass (20 lbs/A); sericea lespedeza (30 lbs/A); bahiagrass (45 lbs/A); and, common bermudagrass (10 lbs/A).

Treatment 5 - Weeping lovegrass (30 lbs/A); sericea lespedeza (30 lbs/A); bahiagrass (45 lbs/A); and, common bermudagrass (10 lbs/A).

This study was designed to evaluate 3 seeding rates of weeping lovegrass and the incorporation of straw prior to seeding on seedling establishment, species composition and soil erosion control. As observed in prior studies, weeping lovegrass is an aggressive species which can inhibit other slower establishing species. The research site selected for this study was a highly erodable and droughty soil (loamy sand) which requires rapid establishment for stabilization. The pre-plant incorporation of 3 tons/A of wheat straw was evaluated as a means to help stabilize the soil and provide organic matter in the root zone for improving soil water and nutrient holding capacity.

Soil analysis and soil particle size distribution results of soil representatives of the plot area are presented in table 8.

Table 8. Soil particle size distribution, phosphorus, potassium, pH and lime requirement of soil representative of Establishment Study IV - 1978 located at the Tenn-Tom Waterway Site (L&N railroad relocation 2 miles east of waterway canal) on a 2.5H:IV east slope exposure in Tishomingo Co., MS.

Soil pH	Lime requirement	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution Sand	Silt	Clay	Soil textural classification
	—Tons/A—	—lbs/A—	—lbs/A—		—%—		
4.9	2	57(L)†	122(L)	90.1	7.6	2.3	Sand

† (L) denotes low availability level of nutrient for plant growth and reproduction.

A completely randomized block design was used and all treatments were replicated 4 times (figure 13). Plot dimensions were 30' x 85' and total plot area was 51,000 sq. ft. All plots were seeded using a hand operated cyclone seeder and mulched with 2 tons straw and 100 gal EA-4 asphalt/A. Preplant lime, fertilizer and straw were incorporated together or fertilizer and lime only on respective plots

6-8" deep using a weighted disc. Fertilizer and lime were derived from a 0-24-24 fertilizer at a rate of 1 ton/A and agricultural grade limestone, at a rate of 2 tons/A, respectively. A crawler-type tractor was used following seeding to firm the seed-bed by tracking the slope area in a horizontal direction.

An iInitial observation was made on June 21, 1978 and showed good seedling establishment on all plots (table 9). Soil erosion was not noticeable across all plots. The four week period between the date of seeding and the initial observation showed periods of mild rainfall intensity and optimum atmospheric temperatures (85-90^{O}F). Species composition consisted of weeping lovegrass and bermudagrass on plots seeded at 10 lbs/A weeping lovegrass. Plots seeded at 20 or 30 lbs/A weeping lovegrass showed 100% weeping lovegrass cover. There was no difference in species composition or % cover between plots with or without preplant straw incorporation. Sericea lespedeza or bahiagrass establishment was not noted at this observation.

An observation on October 27, 1978 showed increased cover on all plots. Increasing seeding rates of weeping lovegrass showed increased % cover. Weeping lovegrass at 10 and 20 lbs/A showed similar % cover and there was no noticeable difference in % vegetative cover between plots with and without preplant straw incorporation. Soil erosion was not noticeable across all plots. Weeping lovegrass and bermudagrass dominated the cover on all plots. Establishment of sericea lespedeza and bahiagrass was not observed.

An observation on May 24, 1979 showed weeping lovegrass dominated stand composition on all plots. Bermudagrass cover

decreased from the last observation across all plots. Sericea lespedeza and bahiagrass establishment was first observed at this observation date. The % cover increased from the last observation date (10-27-78) across all plots.

Later observations on 8-31-79, 5-27-80 and 10-27-80 showed similar trends across all plots. Weeping lovegrass continued to dominate the species composition. Sericea lespedeza and bahiagrass composition increased as observation dates increased. The % cover ranged within the 80 percentile for all plots and soil erosion was not observed throughout these observation dates. There was no real noticeable difference in species composition or % cover between straw incorporation and non-straw incorporated plots.

Summary:

This study evaluated seeding rates of weeping lovegrass and preplant straw incorporation on species composition, % cover and soil erosion control. Weeping lovegrass seeded at 20 lbs/A or greater dominated the stand cover. Weeping lovegrass at 10 lbs/A also dominated the stand, however, bermudagrass establishment was also recorded. Based on these findings, a seeding rate of weeping lovegrass less than 10 lbs/A is required to reduce weeping lovegrass inhibition of other more slowly establishing species. Other more slowly establishing species (sericea lespedeza and bahiagrass) showed establishment 1 year after initiation and increased with time. Bermudagrass which did establish initially declined and was eliminated after 18 months. This loss of bermudagrass may be attributed to competition of weeping lovegrass, winter kill and/or droughty conditions. Soil erosion was checked

completely and overall plot area appeared to be completely stabilized.

Table 9. The effects of seeding rates of weeping lovegrass and preplant straw incorporation on species composition, % cover and soil erosion control on plots located at the Tenn-Tom Waterway Site (2 miles east of the Waterway Canal) on May 22, 1978 on a 2.5H:1V east slope exposure in Tishomingo Co., MS.

Seed mixture	Seeding rate	Preplant straw	Observation date	% Composition				% cover	Soil erosion
				weeping lovegrass	common bermuda	bahia	sericea lespedeza		
	--lbs/A--			%					
weeping lovegrass	10	no	6-21-78	90	10	0	0	40	none
common bermudagrass	10		10-27-78	90	10	0	0	69	none
bahiagrass	45		5-24-79	92	3	5	1	86	none
sericea lespedeza	30		8-31-79	90	0	5	5	87	none
			5-27-80	90	0	5	5	85	none
			10-27-80	87	0	6	7	85	none
weeping lovegrass	20	no	6-21-78	100	0	0	0	58	none
common bermudagrass	10		10-27-78	100	0	0	0	71	none
bahiagrass	45		5-24-79	96	0	3	1	87	none
sericea lespedeza	30		8-31-79	93	0	3	4	89	none
			5-27-80	90	0	3	7	90	none
			10-27-80	88	0	4	8	90	none
weeping lovegrass	30	no	6-21-78	100	0	0	0	53	none
common bermudagrass	10		10-27-78	100	0	0	0	75	none
bahiagrass	45		5-24-79	98	0	1	1	89	none
sericea lespedeza	30		8-31-79	97	0	1	2	85	none
			5-27-80	95	0	1	4	85	none
			10-27-80	92	0	3	4	84	none
weeping lovegrass	10	yes	6-21-78	85	15	0	0	41	none
common bermudagrass	10		10-27-78	90	10	0	0	64	none
bahiagrass	45		5-24-79	93	3	4	<1	82	none
sericea lespedeza	30		8-31-79	92	0	4	4	85	none
			5-27-80	90	0	4	6	87	none
			10-27-80	89	0	5	6	89	none
weeping lovegrass	20	yes	6-21-78	100	0	0	0	46	none
common bermudagrass	10		10-27-78	100	0	0	0	71	none
bahiagrass	45		5-24-79	99	<1	<1	0	85	none
sericea lespedeza	30		8-31-79	98	0	1	1	85	none
			5-27-80	96	0	2	2	82	none
			10-27-80	93	0	3	4	85	none

TREATMENTS:

Treatment 1 (T1) - Weeping lovegrass (10 lbs/A); common bermudagrass (10 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and, 'Serala' sericea lespedeza (30 lbs/A).

Treatment 2 (T2) - Weeping lovegrass (20 lbs/A); common bermudagrass (10 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and, 'Serala' sericea lespedeza (30 lbs/A).

Treatment 3 (T3) - Weeping lovegrass (30 lbs/A); common bermudagrass (10 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and, 'Serala sericea lespedeza (30 lbs/A).

Treatment 4 (T4) - Weeping lovegrass (10 lbs/A); common bermudagrass (10 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and 'Serala' sericea lespedeza (30 lbs/A) and preplant straw incorporation (3 tons/A).

Treatment 5 (T5) - Weeping lovegrass (20 lbs/A); common bermudagrass (10 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and, 'Serala sericea lespedeza (30 lbs/A) and preplant straw incorporation (3 tons/A).

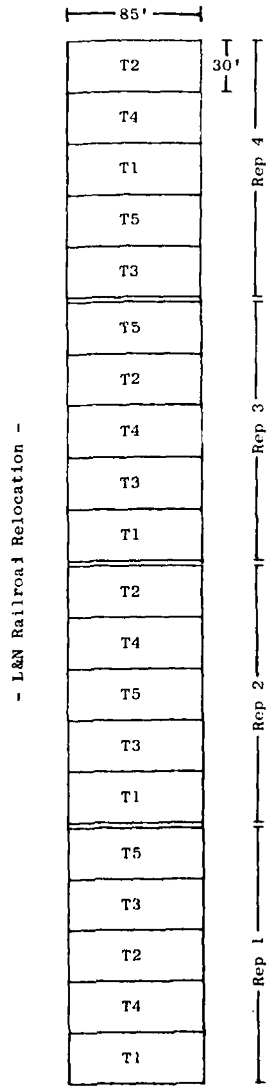

Figure 13. Field plot diagram of Establishment Study VI - 1978 initiated May 22, 1978 in a completely randomized block design located on a 2.5 H:1V east slope exposure at the Tenn Tom Waterway Site (L&N railroad relocation 2 miles east of Waterway canal in Tishomingo Co., MS.

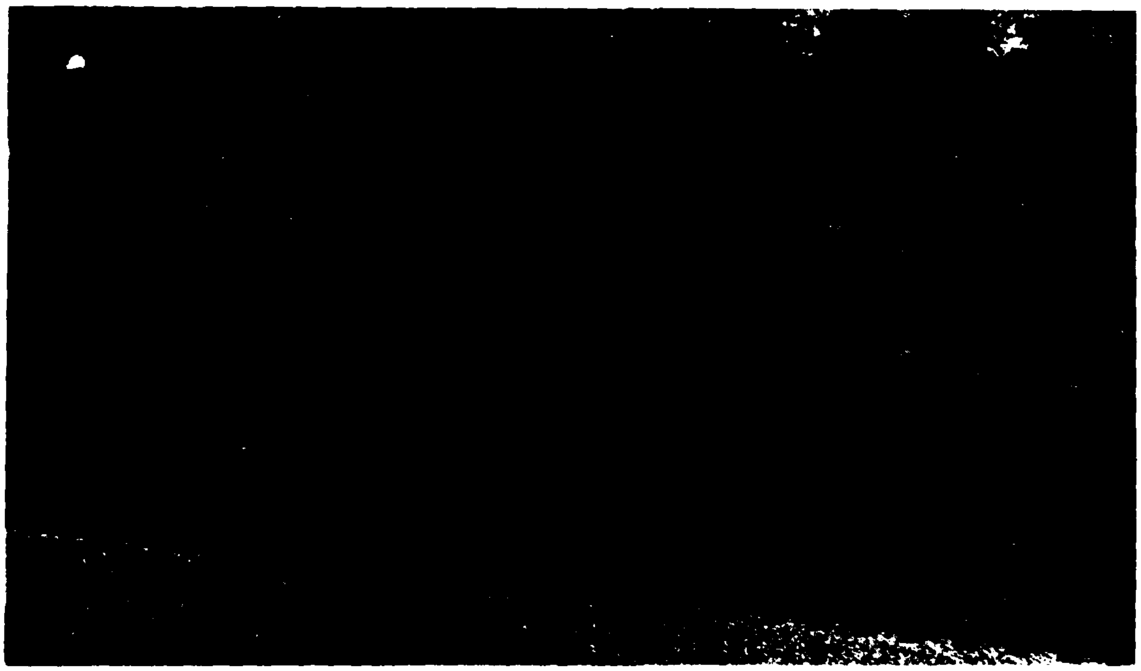

Figure 14. Plot area representative of Establishment Study VI - 1978. (Top) Plot area well established to a stand dominated by weeping lovegrass seeded at 10 lbs/A weeping lovegrass, 30 lbs/A sericea lespedeza, 45 lbs/A bahiagrass and 10 lbs/A common bermudagrass recorded May 2, 1979. (Bottom) Plot area showing well established stand of weeping lovegrass. Bottom 1/2 of plot area fertilized (Refertilization Study IV) with 800 lbs/A 10-20-10 on August 4, 1978. Picture taken on October 10, 1979.

Establishment Study VII - 1978

The Establishment Study VII - 1978 was initiated on May 24, 1978 on plot area located at the Tenn-Tom Waterway Site (2 1/2 miles east of the Waterway Canal) on a 3H:1V west slope exposure.

The plant species used in this study were weeping lovegrass (Eragrostis curvula); sericea lespedeza (Lespedeza cuneata); bahiagrass (Paspalum notatum cv. 'Pensacola'); and common bermudagrass (Cynodon dactylon).

Treatment combinations used in this study included the following:

Treatment 1 - Weeping lovegrass (20 lbs/A); sericea lespedeza (30 lbs/A); bahiagrass (45 lbs/A); and, common bermudagrass (10 lbs/A) mulched with a light-weight nylon-paper webbed mulch[1].

Treatment 2 - Weeping lovegrass (20 lbs/A); sericea lespedeza (30 lbs/A); bahiagrass (45 lbs/A); and, common bermudagrass (10 lbs/A) mulched with a light-weight nylon-paper webbed mulch[1].

Treatment 3 - Weeping lovegrass (20 lbs/A); sericea lespedeza (30 lbs/A); bahiagrass (45 lbs/A); and, common bermudagrass (10 lbs/A) mulched with "HOLD-GRO" a nylon-paper webbed mulch[1].

Treatment 4 - Weeping lovegrass (20 lbs/A); sericea lespedeza (30 lbs/A); bahiagrass (45 lbs/A); and, common bermudagrass (10 lbs/A) mulched with 2 tons/A straw followed by crimping.

[1] Product of Gulf States Paper Company, Tuscaloosa, Al.

This study was designed to evaluate 3 types of nylon-paper webbed mulches and straw-asphalt mulch for soil erosion control and hasten seed germination.

Soil analysis and soil particle size distribution results of soil representative of the plot area are presented in table 11.

Table 11. Soil particle size distribution, phosphorous, potassium, pH and lime requirements of a soil representative of Establishment Study VII - 1978 located at the Tenn-Tom Waterway Site (railroad relocation 2 1/2 miles east of waterway canal) on a 3H:IV west slope exposure in Tishomingo Co., MS.

Soil pH	Lime requirement	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil particle distribution sand	silt	clay	Soil textural classification
	—tons/A--						
4.5	2	49(L)†	130(L)†	90.0	8.1	1.9	Sand

† (L) denotes to low availability level of nutrient for plant growth and reproduction.

A completely randomized block design was used and all treatments replicated 2 times (figure 8). Plot dimensions were 20' x 50' and total plot area was 8,000 sq. ft. All plots were seeded using a hand operated cyclone seeder. Preplant fertilizer and lime were incorporated together 6-8" deep with a weighted disc. Fertilizer was applied at a rate of 1 ton/A and derived from a 0-24-24 commercial grade. Lime was applied at a rate of 2 tons/A and derived from an agricultural grade of limestone. A crawler type tractor was used following seeding to compact the seed-bed by tracking the slopes in a horizontal direction. The nylon-paper webbed mulches were applied under the guidance of a manufacturer representative. Wire staples were used at selected intervals on the mulch to tack it to the soil surface.

An initial observation following seeding was made on June 21, 1978

and showed good stand establishment across all plots (table 10). Weeping lovegrass dominated species composition. Soil erosion was not observed across all plots.

On July 19, 1978 an observation of the plot area showed increased % cover across all plots. Soil erosion was not evident. Plants under the nylon-paper webbing were pushing the mulch upward (6-8") and formed a tent over their respective plot areas.

Observations made on August 10, 1978 showed weeping lovegrass as the dominate plant species on all plots (table 10). Common bermudagrass composition increased noticeably compared to the prior observation date. Bahiagrass and sericea lespedeza showed noticeable yet limited establishment. The % cover and overall stand height was higher on plots mulched with nylon-paper webbing compared to straw-asphalt mulches. Plant samples of all plots were collected for dry weight determination. Results showed significantly higher water content (95-98%) of the vegetation growing under the nylon-paper webbing compared to straw-asphalt mulch (85-88%). This relationship is attributed to the nylon-paper webbed mulch creating a "greenhouse effect" and raising temperatures which cause succulent growth. Soil erosion was not noticeable across all plots. The nylon-paper webbing was intact on all plots and required partial removal in order to make visual observations.

A spring observation on May 24, 1979 showed winter-kill of the majority of vegetation which had grown under the nylon-paper webbed mulch. Localized areas of weeping lovegrass which had grown through the nylon-paper webbed mulch at the point where the staples were used to hold the fabric to the soil surface

did not suffer winter-kill. A combination of weeping lovegrass and bermudagrass composed the stand under the mulch which was winter-killed. Spring green-up was uniform and lacked evidence of winter-kill on plots mulched with straw-asphalt. Soil erosion was not noticeable across all plots and was not immediately affected by the severe winter-kill which occurred under the nylon-paper mulch.

SUMMARY:

This study evaluated nylon-paper webbed mulches and a straw-asphalt mulch for soil erosion control and hastened seed germination. No difference in soil erosion control was observed between mulches. Rainfall during stand establishment was moderate and seedling establishment was good. Species composition did not vary noticeably between the nylon-paper mulches and the straw-asphalt mulch. The % cover was relatively similar across all plots. Plants under the nylon-paper mulches suffered noticeable winter-kill following the 1st winter season. This finding was not observed for plants grown under a straw-asphalt mulch. Winter-kill of the vegetation under the nylon-paper webbed mulch was attributed to a "greenhouse effect" caused by the nylon-paper mulches which maintained elevated temperatures and prevented hardening off of plants prior to freezing temperatures. Soil erosion was immediately not affected by the winter-kill of vegetation under the nylon-paper webbed mulches. Long term effects of winter-kill on soil erosion and/or regrowth was not investigated beyond this observation date. Based on the findings of this study no mulch evaluated was superior in controlling soil erosion

or hastening seed germination. The winter-kill of vegetation under the nylon-paper webbed mulch should be investigated further to verify and elucidate the causes of this occurence.

Table 10. The effects of mulch type on species composition, % cover and soil erosion control on plots seeded to a seed mix at the Tenn-Tom Waterway Site (2 1/2 miles east of the Tenn-Tom Waterway Canal on May 24, 1978 on a 3H:IV west slope exposure in Tishomingo Co., MS.

Seed mixture	Seeding rate	Mulch†	Observation date	Species Composition: weeping lovegrass	common bermuda	bahia	sericea lespedeza	% cover	Soil erosion
	--lbs/A--								
weeping lovegrass	20	light-weight	6-21-78	95	5	0	0	65	none
common bermudagrass	10	nylon paper	8-10-78	82	13	5	2	92	none
bahiagrass	45	webbing	5-24-79	80	0	10	10	29	none
sericea lespedeza	30								
weeping lovegrass	20	heavy-weight	6-21-78	90	10	0	0	55	none
common bermudagrass	10	nylon paper	8-10-78	78	14	4	4	94	none
bahiagrass	45	webbing	5-24-79	75	0	15	10	30	none
sericea lespedeza	30								
weeping lovegrass	20	"HOLD-GRO"	6-21-78	93	7	0	0	60	none
common bermudagrass	10	nylon paper	8-10-78	76	18	4	2	94	none
bahiagrass	45	webbing	5-24-79	78	0	12	10	25	none
sericea lespedeza	30								
weeping lovegrass	20	2 tons/A straw	6-21-78	100	0	0	0	54	none
common bermudagrass	10	+ 100 gal.	8-10-78	76	16	6	2	90	none
bahiagrass	45	asphalt	5-24-79	87	0	7	6	87	none
sericea lespedeza	30								

† Mulches consisting of a nylon paper webbing are products of Gulf States Paper Company, Tuscaloosa, Al.

‡ All treatments replicated 2 times in a completely randomized block design.

TREATMENTS:

Treatment 1 (T1) - Weeping lovegrass (20 lbs/A); common bermudagrass (10 lbs/A); bahiagrass (45 lbs/A); and, sericea lespedeza (30 lbs/A) mulched with light-weight nylon-paper webbing.

Treatment 2 (T2) - Weeping lovegrass (20 lbs/A; common bermudagrass (10 lbs/A); bahiagrass (45 lbs/A); and, sericea lespedeza (30 lbs/A) mulched with heavy-weight nylon-paper webbing.

Treatment 3 (T3) - Weeping lovegrass (20 lbs/A); common bermudagrass (10 lbs/A); bahiagrass (45 lbs/A); and, sericea lespedeza (30 lbs/A) mulched with HOLD-GRO (a nylon-paper webbing).

Treatment 4 (T4) - Weeping lovegrass (20 lbs/A); common bermudagrass (10 lbs/A); bahiagrass (45 lbs/A); and, sericea lespedeza (30 lbs/A) mulched with 2 tons/A straw-asphalt mulch.

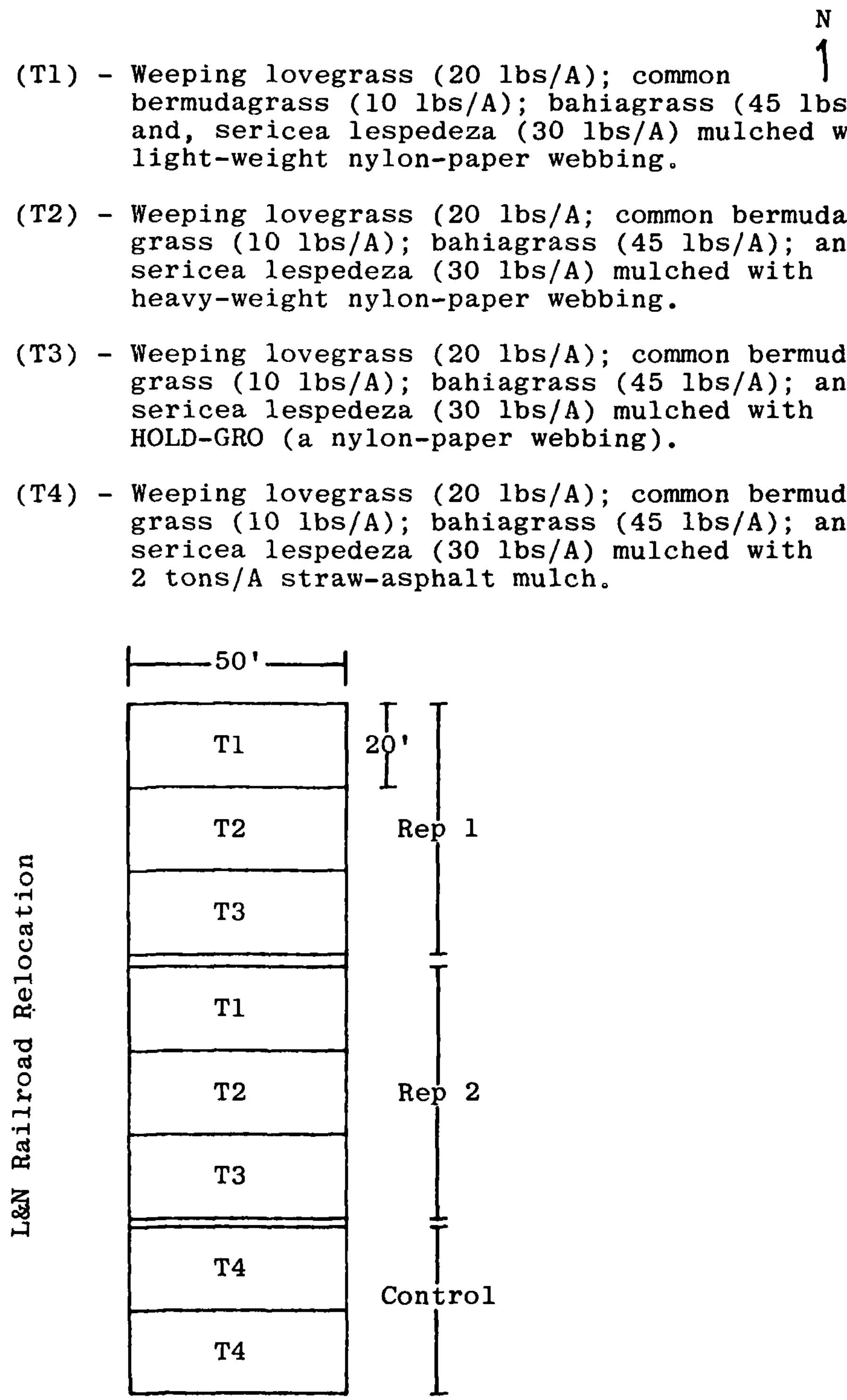

Figure 15: Field plot diagram of Establishment Study VII - 1978 initiated May 24, 1978 in a completely randomized block design located on a 3H:IV west slope exposure at the Tenn-Tom Waterway Site (L&N railroad relocation 2 1/2 miles east of Waterway Canal) in Tishomingo Co., MS.

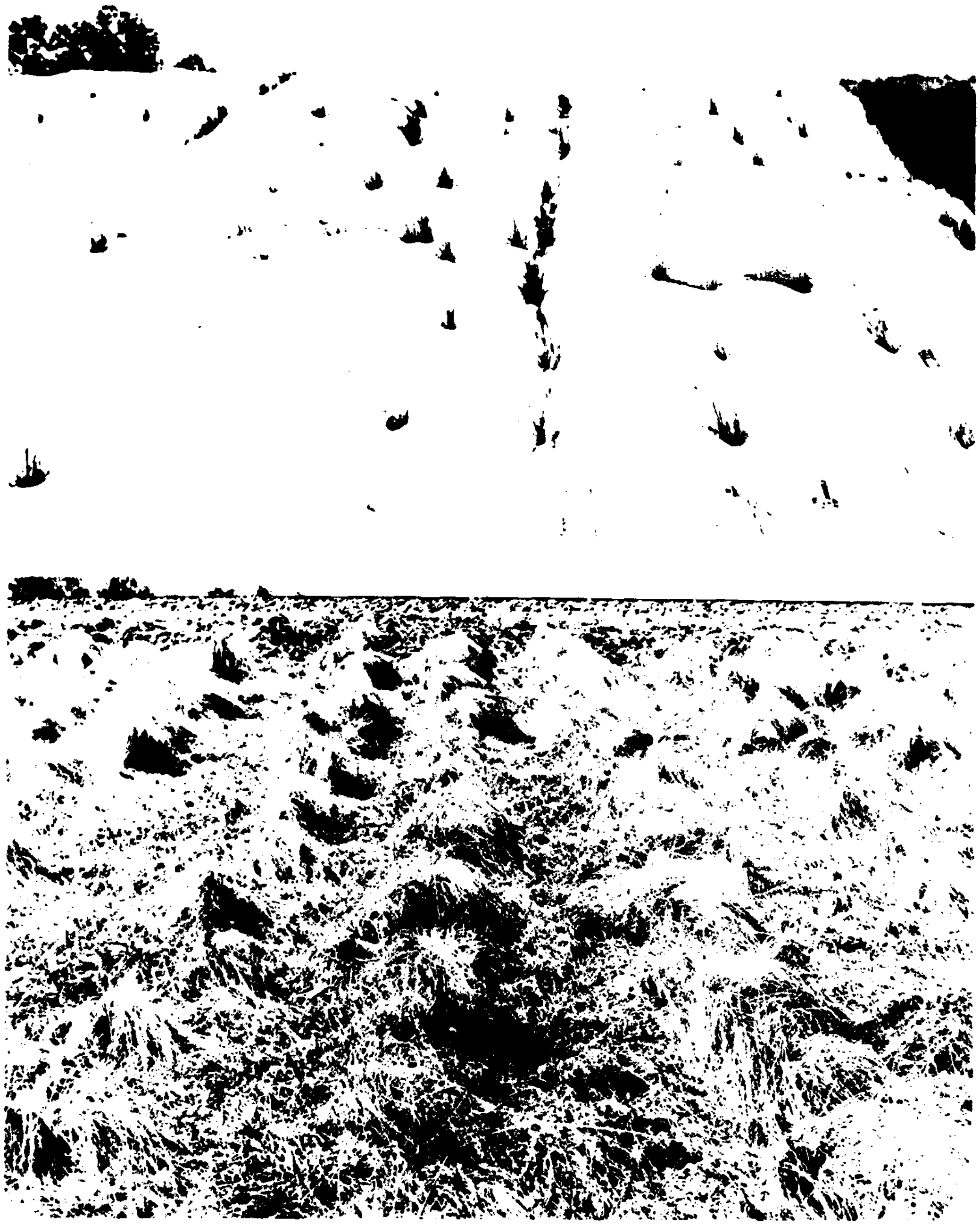

Figure 15. Plot area representative of Establishment Study VII - 1978. Plot area mulched with a light-weight nylon-paper webbing showing weeping lovegrass emergence at the point of the staple penetration through the fabric. Vegetation under the mulch has formed a tent covering causing a "greenhouse" effect. Picture taken on August 10, 1978. (Bottom) Same plot area as shown above showing winter-kill of vegetation under the nylon-paper webbed mulch and survival of weeping lovegrass at the points of staple penetration. Picture taken on May 10, 1979.

Establishment Study VIII - 1978

The Establishment Study VIII - 1978 was initiated on August 28, 1978 on a plot area located at the Tenn-Tom Waterway Site (L&N railroad relocation 3 miles east of waterway canal) on a 2.5H:IV east slope exposure.

The plant species used in the study were weeping lovegrass (*Eragrostis curvula*); bahiagrass (*Paspalum notatum* cv. 'Pensacola'); sericea lespedeza (*Lespedeza cuneata* cv. 'Serala'); hairy vetch (*Vicia villosa*); and crimson clover (*Trifolium incarnatum* cv. 'Dixie Reseeding').

Treatment combinations used in this study included the following.

Treatment 1 - Weeping lovegrass (15 lbs/A); bahiagrass (45 lbs/A); common bermudagrass (10 lbs/A); hairy vetch (30 lbs/A); and crimson clover (30 lbs/A). (Mixed Seeding)

Treatment 2 - Alternative strips of weeping lovegrass (2.5 lbs/A); bahiagrass (45 lbs/A); sericea lespedeza (30 lbs/A); hairy vetch (30 lbs/A); and crimson clover (30 lbs/A) (5' wide) and weeping lovegrass (20 lbs/A) and common bermudagrass (10 lbs/A) (15' wide). (Contour Seeding)

This study was designed to evaluate two methods of seeding on seeding establishment, species composition, % cover and soil erosion control. Previous research findings had shown weeping lovegrass as a rapidly establishing species capable of dominating

a vegetative stand when planted in a mixture. This study attempted to evaluate seeding in alternate strips using rapidly establishing species (RES) altered with more slowly establishing species (SES) contour seeding. Weeping lovegrass and bermudagrass (RES) were seeded together in strips 15 ft. wide followed by 5 ft. wide strips of sericea lespedeza, bahiagrass, hairy vetch, and crimson clover (SES) seeded together. This sequence of alternating strips was planted horizontally down the slopes. It was anticipated that the strips of weeping lovegrass and bermudagrass would stabilize slopes while allowing legumes and slower establishing species to establish and create a nurse stock of vegetation and/or seed for encroachment. This method of alternate seeding (contour seeding) was compared with conventional seeding using a mixture of species seeded simultaneously (mixed seeding).

Soil analysis and soil particle size distribution results of soil representative of the plot area are presented in table 12.

Table 12. Soil particle size distribution, phosphorus, potassium, pH and lime requirements of soil representative of Establishment Study VIII - 1978 located at the Tenn-Tom Waterway Site (L&N railroad relocation 3 miles east of waterway canal) on a 2.5H:IV east slope exposure in Tishomingo Co., MS.

	Soil pH	Lime requirements	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution Sand	Silt	Clay	Soil Textural Classification
		---tons/A---	---lbs/A---		---%---			
Surface‡ soil	5.4	2.0	55(L)†	130(L)	65.0	21.8	13.2	Sandy Loam
Subsoil soil	5.0	2.0	45(L)	121(L)	84.6	9.6	5.8	Loamy Sand

† (L) denotes low availability level of nutrient for plant growth and reproduction.

‡ Surface soil refers to the soil layer plated over the subsoil derived from an adjacent surface area. Subsoil refers to the soil layer which is representative of the soil exposure following excavation of slope.

A completely randomized block design was used and all treatments were replicated 5 times (figure 17). Plot dimensions were 30' x 85' and total plot area was 25,500 sq. ft. All plots were seeded using a hand operated cyclone seeder and mulched with 2 tons straw and 100 gal. EA-4 asphalt/A. The slope surface was plated with 10-12 inches of a loamy sand soil across the entire slope surface. Preplant fertilizer and lime were incorporated 6-8" deep using a weighted disc. Fertilizer and lime were derived from a 0-24-24 fertilizer at a rate of 1 ton/A and agricultural grade limestone at a rate of 2 tons/A, respectively. The seedbed surface was compacted with a culti-packer pulled horizontally across the slope surface immediately following seeding and prior to straw-asphalt mulch application.

An initial observation on September 21, 1978 showed good establishment across all plots (table 13). Soil erosion was not noticeable and was similar for all plot areas. Weeping lovegrass, common bermudagrass, hairy vetch and crimson clover were the dominate species during early establishment on the mixed seed plots. Sericea lespedeza was noticeable to a lesser degree. Bahiagrass seedlings were not observed at this observation. Species composition in the contour seeding plots within the RES area showed good establishment of weeping lovegrass and bermudagrass. The % cover of this area was 80%. In the alternating strips of SES, hairy vetch and crimson clover seedling dominated. Sericea lespedeza and bahiagrass seedling were limited.

A later observation was made of the plot area on November 21, 1978 and revealed no noticeable soil erosion across all plots. The % cover was similar for both methods of seeding. The warm

season species (weeping lovegrass, common bermudagrass, sericea lespedeza) were in semi-dormancy at the time of this observation. The species composition for each seeding method was similar to that reported during the initial observation (September 21, 1978).

A May 24, 1979 observation showed hairy vetch and crimson clover as dominate species on the mixed seeding treatment and in the strip of SES in the contour seeding treatments. Total shoot growth from the hairy vetch exceeded that of the crimson clover and appeared to dominate the total cover. Weeping lovegrass and bermudagrass were the dominate species in the contour seeding strip of the RES. A soil sample taken at this time showed pH of 6.4 and high and medium levels of available phosphorus and potassium, respectively.

An observation on August 31, 1979 showed greater % cover on mixed seeding plots compared to the contour seeding plots. This difference did not affect soil erosion control as both cover were sufficient to control soil movement. The bermudagrass and weeping lovegrass composition was low for both the mixed and contour seeding methods. The dominate species which occurred in strips of RES in the contour seeding treatment were bermudagrass, weeping lovegrass, volunteer tall fescue (originating from the straw mulch) and weeds (lambs quarter, dock, etc.).

An observation on October 10, 1979 showed noticeably greater species composition of crimson clover compared to hairy vetch. Bahiagrass was noticeable in all plots and was especially dominate in the strips of SES in the contour seeding treatment. Soil erosion remained unchanged across all plots.

An observation on May 27, 1980 showed an increase in crimson

clover and a decrease in hairy vetch composition in both mixed and contour seeded plots. Weeping lovegrass and bermudagrass composition remained relatively stable compared to the previous observation. Bahiagrass showed a slight decline, however, this may be attributed to late spring green-up and masking by the other vegetation. Soil erosion was not noticeable across all plots. The % cover across all plot areas was also similar.

An observation on October 27, 1980 revealed similar trends reported for the previous observation date, except bahiagrass composition increased noticeably for both mixed and contour seeded plots.

Summary:

This study was designed to evaluate mixed and contour seeding methods for controlling soil erosion on slopes. Both seeding methods controlled soil erosion very well. Neither method proved to be superior based on stabilization of distributed soils on slopes, however, the concept of contour seeding did prove successful. Contour seeding may be useful with other species and seeding dates where competition would also be more critical.

Overall, crimson clover increased progressly over time, whereas; hairy vetch declined. This decline in hairy vetch limits its potential as a persistent annual legume. Bahiagrass and sericea lespedeza increased in density over time and showed good persistence. Bermudagrass and weeping lovegrass declined slightly and remained stable.

Table 13. The effects of mixed seeding and contour seeding on the % species composition, % cover and soil erosion control on a 2.5H:VI east slope exposure in Tishomingo County, Mississippi.

Observation Date	Seeding Method	Species Composition: Crimson clover	Hairy vetch	Weeping lovegrass	Common bermudagrass	Sericea lespedeza	Bahia-grass	Others	Percent Cover	Soil Erosion
		%							%	
9-21-78	Mixed	20	50	15	15	2	0	0	80	none
	Contour	10	20	45	25	1	0	0	80	none
5-24-79	Mixed	25	50	5	10	3	6	1	85	none
	Contour	10	32	40	10	3	3	2	82	none
10-10-79	Mixed	20	40	3	10	3	14	10	90	none
	Contour	20	30	20	13	1	10	6	75	none
5-27-80	Mixed	38	17	7	9	14	7	9	87	none
	Contour	23	25	21	16	8	4	4	84	none
10-27-80	Mixed	35	6	6	8	12	27	6	87	none
	Contour	31	5	18	17	8	18	3	87	none

TREATMENTS:

Treatment 1 (T1) - Mixed seeded: weeping lovegrass (5 lbs/A); common bermudagrass (10 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); sericea lespedeza (30 lbs/A); hairy vetch (30 lbs/A); and, crimson clover (30 lbs/A).

Treatment 2 (T2) - Alternating seeded strips: Slowly Establishing Species (SES) [bahiagrass (45 lbs/A); sericea lespedeza (30 lbs/A); hairy vetch (30 lbs/A); and, crimson clover (30 lbs/A)]. Rapid Establishing Species (RES) [weeping lovegrass (20 lbs/A) and common bermudagrass (10 lbs/A)].

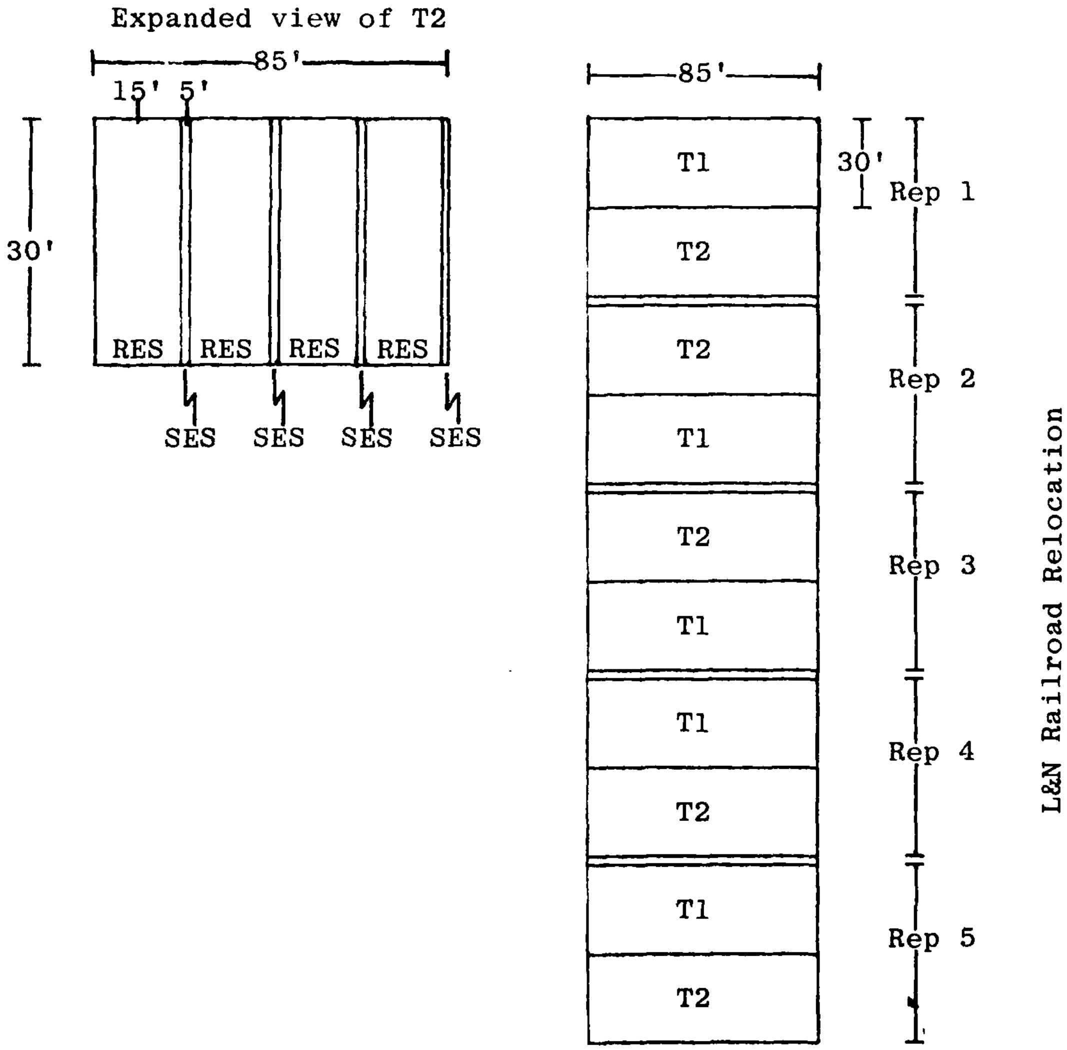

Figure 17: Field plot diagram of Establishment Study VIII - 1978 initiated August 28, 1978 in a completely randomized block design located on a 2.5 H:IV east slope exposure at the Tenn-Tom Waterway Site (L&N railroad relocation 3 miles east of waterway canal) in Tishomingo Co., MS.

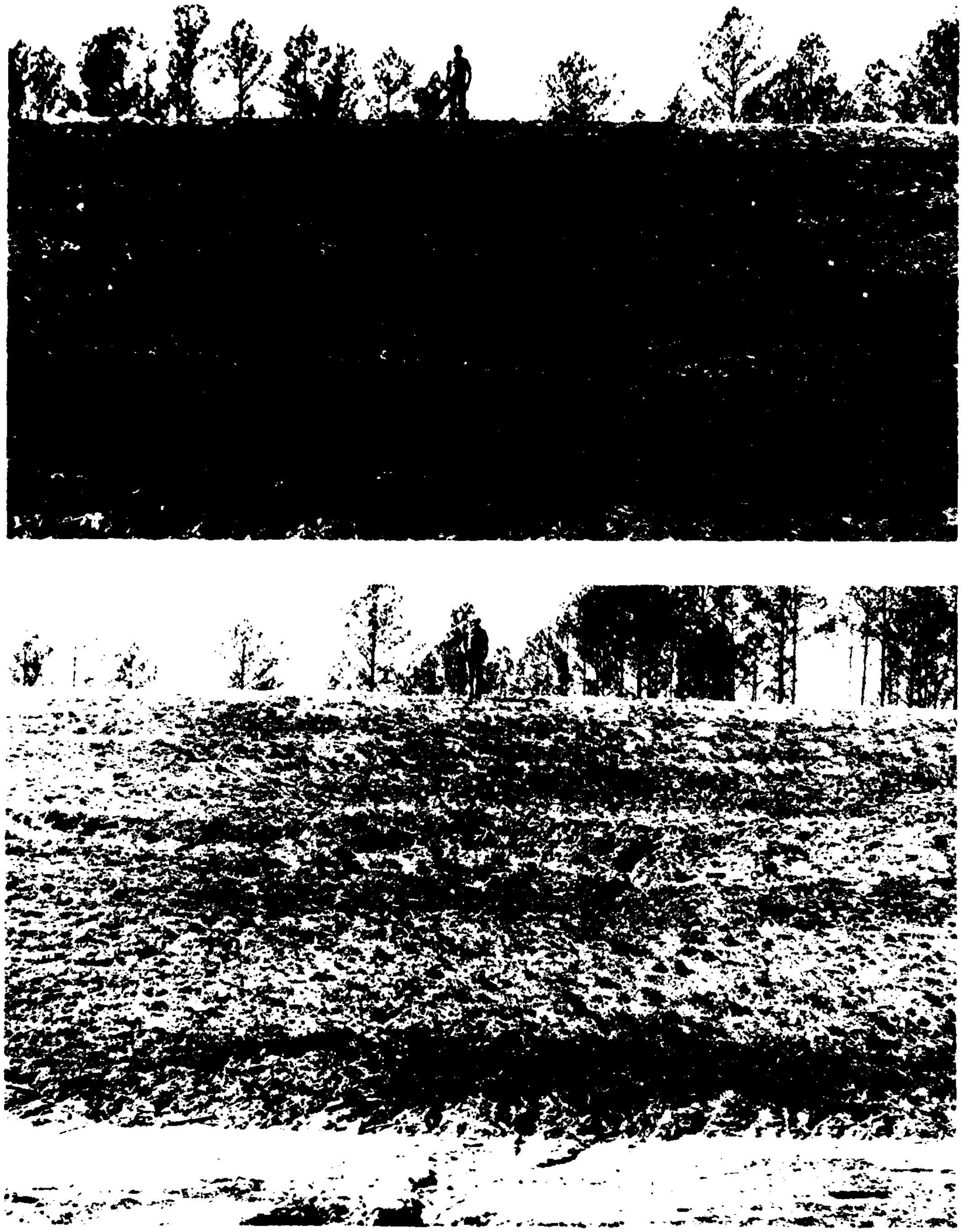

Figure 18. Plot area representative of Establishment Study VII - 1978. (Top) Plot area showing seedling establishment of hairy vetch, crimson clover, weeping lovegrass, and common bermudagrass seeded as a mixed seeding at 15 lbs/A weeping lovegrass, 45 lbs/A bahiagrass, 10 lbs/A common bermudagrass, 30 lbs/A hairy vetch and 30 lbs/A crimson clover recorded May 10, 1979. (Bottom) Plot area showing alternate strips (contour seeding) of slowly establishing species (bahiagrass, sericea lespedeza, hairy vetch and crimson clover - 5' wide) and rapidly establishing species (weeping lovegrass and common bermudagrass - 15' wide) recorded May 10, 1979.

Figure 19. Plot area representative of Establishment Study VIII - 1978. (Top) Plot area showing stand establishment dominated by hairy vetch in the slow establishing species strips 10 months following seeding. Picture taken on June 2, 1979. (Bottom) Same plot area showing stand establishment dominated by crimson clover and bahiagrass in the slowly establishing species strips 22 months following seeding. Picture taken May 10, 1979.

Overseeding Study I - 1978

Overseeding Study I - 1978 was initiated on March 30, 1978 on a plot area located at the Tenn-Tom Waterway Site (test trench) on a 2H:IV east slope exposure.

The plant species used in this study were bahiagrass (Paspalum notatum cv. 'Pensacola'); common bermudagrass (Cynodon dactylon); tall fescue (Festuca arundinaceae cv. 'Ky. 31'); and sericea lespedeza (Lespedeza cuneata cv. 'Serala').

Treatment combinations used in this study included the following:

Treatment 1 - Common bermudagrass (20 lbs/A); bahiagrass (45 lbs/A); and sericea lespedeza (30 lbs/A) using dry seed application.

Treatment 2 - Bahiagrass (45 lbs/A); and sericea lespedeza (30 lbs/A) using dry seed application.

Treatment 3 - Bahiagrass (45 lbs/A); sericea lespedeza (30 lbs/A); and tall fescue (pre-soaked seed) (50 lbs/A) using a hydroseeder.

This study was designed to evaluate the effects of overseeding (the direct seeding of a plant species into an established vegetative stand) selected plant species using dry and hydroseeding methods of application. In general, overseeding objectives are to intergrate a stand with the overseed species and/or increase stand density for improving soil erosion control. Hydroseeding is used for sites in which transport of equipment across the seedbed is prohibitive or as a means to apply presoaked seeds. Pre-soaked seeds are seeds which have been submerged in water for a period of time

to hasten germination.

The site selected for this study was composed of 100% weeping lovegrass and % cover estimated at 80-90%. The area was burned accidentally approximately one month prior to overseeding. This unforeseen burning was capitalized upon as a means for removing a dense canopy of dead leaves and reducing competition of the weeping lovegrass.

Soil analysis and soil particle size distribution results of soil representative of the plot area are presented in table 13.

Table 14. Soil particle size distribution, phosphorus, potassium, pH and lime requirements of soil representative of Overseeding Study I - 1978 located at the Tenn-Tom Waterway Site (test trench) on a 2H:IV east slope exposure in Tishomingo Co., MS.

Soil pH	Lime Requirements	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution sand	silt	clay	Soil Textural Classification
	----tons/A----	---------lbs/A---------					
6.6	2.0	408(H)†	569(H)	86.8	9.1	4.1	Loamy Sand

† (H) denotes high availability of nutrient for plant growth and reproduction.

A completely randomized block design was used and all treatments were replicated 4 times (figure 20). Plot dimensions were 30' x 30' and total plot area was 10,800 sq. ft. Plots were seeded using a hand-operated cyclone seeder or hydroseeder. The hydroseeder was a demonstration model manufactured by Finn Equipment Co. Tall fescue seeds used in each hydroseeded mixture were pre-soaked in tap water for 24 hrs. prior to seeding. The seed mixture for hydroseeding was applied in 75 gallons of water at 70 psi per plot.

An initial observation on June 1, 1978 showed all plots to be composed predominately of weeping lovegrass (table 15). The weeping lovegrass showed rapid recovery following burning and plant height

of weeping lovegrass averaged 45" across all plots. Slope stabilization was not altered by burning and all plots showed no noticeable soil erosion. Overseeding with bahiagrass, sericea lespedeza, and common bermudagrass showed greater sericea lespedeza establishment compared to the other species. No noticeable establishment of common bermudagrass, bahiagrass, or tall fescue were observed across all plots at the time of this observation. There was no difference in species composition between dry and hydroseeding applications.

A fall observation on September 10, 1978 showed weeping lovegrass as the dominant species across all treatments. There was no noticeable differences in the amount of sericea lespedeza between treatments at this observation. The average sericea lespedeza composition was estimated at 5% of the total cover. Common bermudagrass, bahiagrass and tall fescue plants were not observed in any plots. There was no difference in species composition between dry and hydroseeding applications.

<u>Summary</u>:

This study evaluated the overseeding of selected species using dry and hydroseeding methods of seed application on a slope composed predominately of weeping lovegrass. Dry seed application and hydroseeding showed no difference in establishment of the overseeded species. Sericea lespedeza was the only species to establish successfully. Burning weeping lovegrass prior to spring green-up did not effectively open the existing canopy to allow establishment of other overseeded species. Regrowth of weeping lovegrass following burning was rapid and inhibited the establishment of the overseeded species. Cultivation or chemical inhibition of

the established species is necessary for successful overseeding establishment.

Table 15. The effects of dry and hydroseeding application on the % species composition, % cover and soil erosion control of selected seed mixture overseeded into a pure stand of weeping lovegrass on a 2H:IV east slope exposure in Tishomingo Co., MS.

Observation date	Seed mix	Seeding rates	Seed application	Species Composition: weeping lovegrass	sericea lespedeza	bahiagrass	common bermuda	tall fescue	% cover	Soil erosion
		--lbs/A--		----------	----------	%	----------	----------		
6-1-78	bahiagrass	45	dry	96	4	0	0	0	90	none
9-10-78	sericea lespedeza	30	broadcast	95	5	0	0	0	91	none
	common bermuda	20								
6-1-78	bahiagrass	45	dry	99	1	0	0	0	87	none
9-10-78	sericea lespedeza	30	broadcast	95	5	0	0	0	92	none
6-1-78	bahiagrass	45	hydroseeded	98	2	0	0	0	89	none
9-10-78	sericea lespedeza	30		93	7	0	0	0	90	none
	tall fescue†	50								

† Tall fescue seed pre-soaked for 24 hours in tap water prior to seeding.

TREATMENTS:

Treatment 1 (T1) - Common bermudagrass (20 lbs/A); 'Pensacola' bahiagrass (45 lbs/A); and 'Serala' sericea lespedeza (30 lbs/A) broadcasted as dry seed.

Treatment 2 (T2) - 'Pensacola' bahiagrass (45 lbs/A); and 'Serala' sericea lespedeza (30 lbs/A) broadcasted as dry seed.

Treatment 3 (T3) - 'Pensacola' bahiagrass (45 lbs/A); 'Serala' sericea lespedeza (30 lbs/A); and tall fescue (pre-soaked 24 hrs.) (50 lbs/A) broadcasted using a hydroseeder.

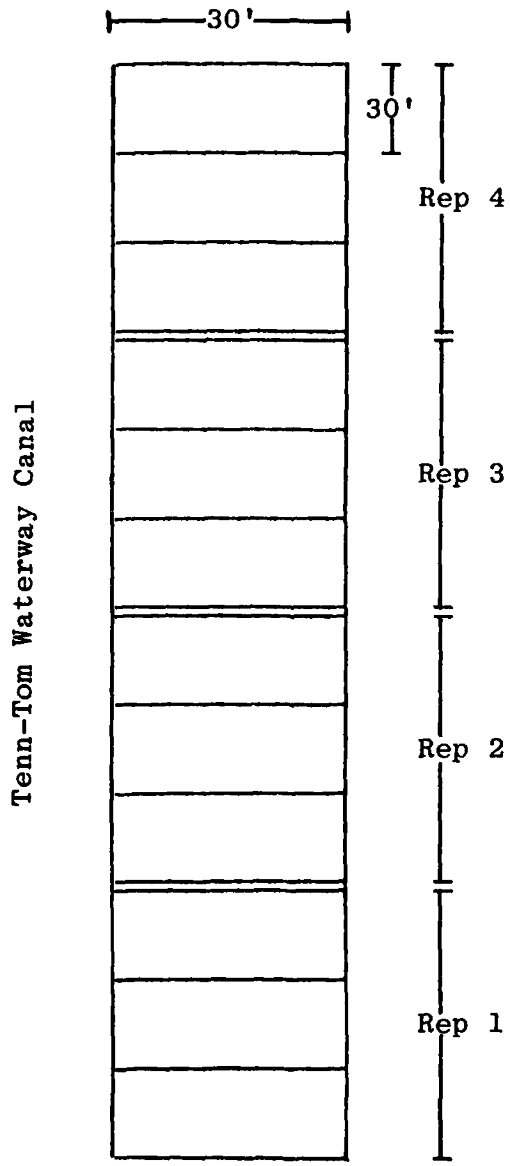

Figure 20: Field plot diagram of Overseeding Study I - 1978 initiated March 30, 1978 in a completely randomized block design located on a 2H:IV east slope exposure at the Tenn-Tom Waterway Site (test trench) in Tishomingo Co., MS.

Figure 21. Plot area representative of Overseeding Study I - 1978. Plot area prior to overseeding which was accidentally burned and overseeded with a seed mix containing common bermudagrass, sericea lespedeza and bahiagrass using dry and hydroseeding methods of distribution.

Overseeding Study II - 1978

Overseeding Study II - 1978 was initiated on June 24, 1978 on a plot area located at the Tenn-Tom Waterway Site (Section 4A) on a 2H:IV west slope exposure.

The plant species used in this study were bahiagrass (*Paspalum notatum* cv. 'Pensacola'); and sericea lespedeza (*Lespedeza cuneata* cv. 'Interstate').

Treatment combinations used in this study included the following:

Treatment 1 - Bahiagrass (45 lbs/A) and, sericea lespedeza (30 lbs/A).

Treatment 2 - Bahiagrass (45 lbs/A) and, sericea lespedeza (30 lbs/A) followed by light discing.

This study was designed to evaluate light discing as a cultivation practice to improve establishment of overseeded species into an established stand of weeping lovegrass. Light discing was used to reduce competition of the established stand and improve seedling establishment.

Soil analysis and soil particle size distribution results of soil representative of the plot area are presented in table 16.

Table 16. Soil particle size distribution, phosphorus, potassium, pH, and lime requirements of soil representative of Overseeding Study II - 1978 located at the Tenn-Tom Waterway Site (Section 4A) on a 2H:IV west slope exposure.

Soil pH	Lime Requirements	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution sand	silt	clay	Soil Textural Classification
	----tons----	---lbs/A---	--lbs/A--	----------	%	----------	
5.5	2	452(H)†	569(H)	90.2	5.4	4.4	Sand

† (H) denotes high level of availability of nutrient for plant growth and reproduction.

A completely randomized block design was used and all treatments were replicated 3 times (figure 22). Plot dimensions were 90' x 60' and total plot area was 32,400 sq. ft. Species composition of plot area prior to overseeding was 100% weeping lovegrass. Lime application of 2 tons/A was applied across the plot area prior to seeding using an agricultural grade limestone. Seeding was done with a hand operated cyclone seeder. Discing following seeding was performed with a crawler-type tractor traveling horizontally across the slope. The entire plot surface was disced on those respective treatments.

An initial observation on July 19, 1978 showed greater establishment of sericea lespedeza and bahiagrass on the disced plots compared to the non-disced plots (table 17). Slope stabilization was not affected by discing. Recovery of weeping lovegrass following discing was rapid and total % cover of both plot areas were similar at the time of this observation date.

An observation October 31, 1978 showed results similar to those reported for the July 19, 1978 observation. Total cover for both disced and non-disced plots were similar and establishment of both species used in overseeding was greater in disced plots compared to plots not disced.

An observation on March 7, 1979 showed no significant erosion across all plots. Weeping lovegrass bahiagrass, and sericea lespedeza plants were beginning spring green-up.

An observation on May 24, 1979 showed less % cover on plots disced compared to non-disced plots. Percent composition of species showed greater bahiagrass and sericea lespedeza on disced compared to plots not disced. Soil erosion was similar and not

significant across plots.

An observation on September 27, 1979 showed findings similar to results recorded at the May 24, 1979 observation. Greater establishment of overseeded species was recorded on the disced plots compared to plots not disced. The % cover was less on the disced plots compared to the non-disced plots. Soil erosion was not noticeable across all plots.

<u>Summary</u>:

This study evaluated discing as a cultivation practice to aid in the establishment of plant species overseeded into an established stand of weeping lovegrass. Discing proved to be a beneficial cultivation practice and aided significantly in the establishment of the overseeded species. Discing did not jeopardize slope stabilization. Recovery of weeping lovegrass following discing was rapid. Discing did reduce overall % cover of the slope, however, this reduction did not affect soil erosion control.

Table 17. The effects of light discing on the establishment of overseeded species seeded into an established stand of weeping lovegrass on June 24, 1978 located on a 2H:IV west slope exposure at the Tenn-Tom Waterway Site (Section 4A) in Tishomingo Co., MS.

Observation Date	Seed Mixture	Seeding Rate	Discing	Species Composition: Weeping lovegrass	Species Composition: Bahiagrass	Species Composition: Sericea lespedeza	% Cover	Soil Erosion
		--lbs/A--		%	%	%		
7-19-78	Bahiagrass	50	yes	62	8	30	88	none
10-31-78	Sericea lespedeza	30		65	10	25	92	none
5-27-79				70	10	30	70	none
9-27-79				68	10	32	75	none
7-19-78	Bahiagrass	50	no	97	0	3	90	none
10-31-78	Sericea lespedeza	30		98	0	2	94	none
5-27-79				95	0	5	90	none
9-27-79				90	0	10	92	none

N

TREATMENTS:

Treatment 1 (T1) - 'Pensacola' bahiagrass (45 lbs/A); and, 'Serala' sericea lespedeza (30 lbs/A).

Treatment 2 (T2) - 'Pensacola' bahiagrass (45 lbs/A); and, 'Serala' sericea lespedeza (30 lbs/A) followed by light discing.

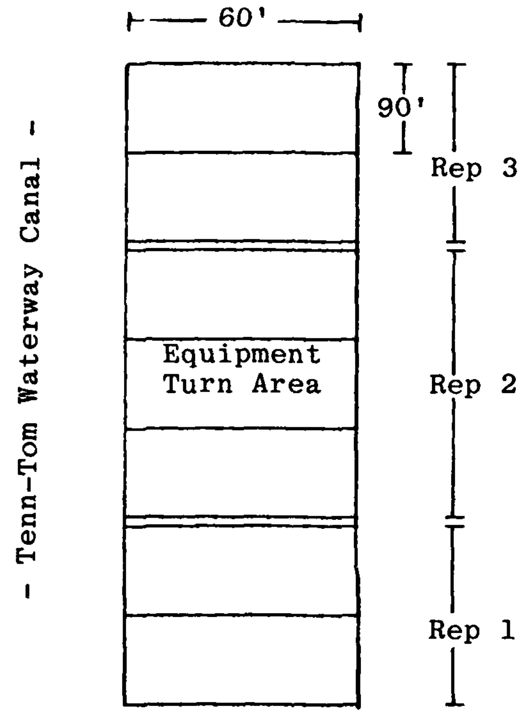

Figure 22: Field plot diagram of Overseeding Study II - 1978 initiated June 24, 1978 in a completely randomized block design located on a 2H:IV west slope exposure at the Tenn-Tom Waterway Site (Section 4A) in Tishomingo Co., MS.

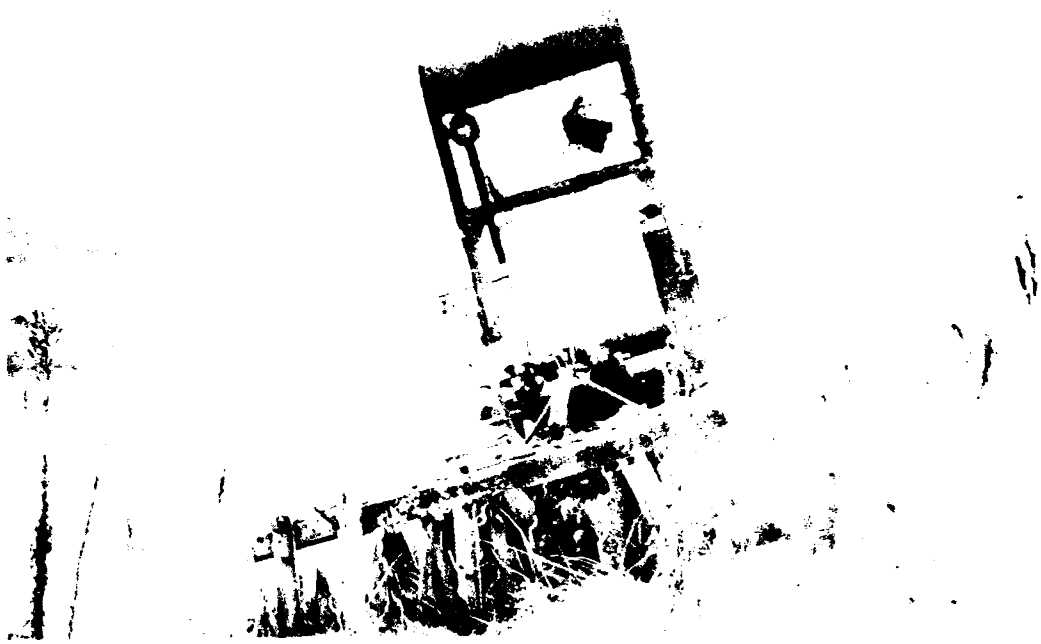

Figure 23. (Top) Plot area representative of Overseeding II - 1978. Light discing was performed across the plot area using a crawler-type tractor and disc pulled horizontally across the slope in order to reduce established vegetative competition and create a suitable seedbed. (Bottom) Plot area representative of Overseeding III - 1978. Light discing was done across the slope surfaces in alternating strips 12' wide showing presence of hairy vetch residue in the disced area. Pictures taken in August 1979.

Overseeding Study III - 1978

The Overseeding Study III - 1978 was initiated on September 13, 1978 on plot area located at the Tenn-Tom Waterway Site (Section 4A) on a 2H:IV west slope exposure.

The plant species used in this study were tall fescue (Festuca arundinacea, cv. 'Ky 31'), hairy vetch (Vicia villosa), and crimson clover (Trifolium incarnatum, cv. 'Dixie Reseeding').

Treatment combinations used in this study included the following:

Treatment 1 - Tall fescue (15 lbs/A); hairy vetch (15 lbs/A); and crimson clover (10 lbs/A).

Treatment 2 - Tall fescue (30 lbs/A); hairy vetch (30 lbs/A); and crimson clover (20 lbs/A).

This study was designed to evaluate seeding rates of tall fescue, hairy vetch and crimson clover overseeded into an established stand of weeping lovegrass. Previous overseeding studies used warm season species for overseeding at a spring seeding date. This study evaluated cool season species overseeded at a fall seeding date.

Soil analysis and soil particle size distribution results of soil representative of the plot area are presented in table 18.

Table 18. Soil particle size distribution, phosphorus, potassium, pH and lime requirements of soil representative of Overseeding Study III - 1978 located at the Tenn-Tom Waterway Site (Section 4A) on a 2H:IV west slope exposure.

Soil pH	Lime Requirements	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution sand	silt	clay	Soil Textural Classification
	----tons----	--lbs/A--	--lbs/A--	---------- % ----------			
5.9	1.5	560(H)†	595(H)	74.6	14.7	10.7	Sandy Loam

† (H) denotes high level of availability of nutrient for plant growth and reproduction.

AD-A108 318 MISSISSIPPI AGRICULTURE AND FORESTRY EXPERIMENT STATI--ETC F/G 8/13
VEGETATIVE EROSION CONTROL STUDIES TENNESSEE-TOMBIGBEE WATERWAY--ETC(U)
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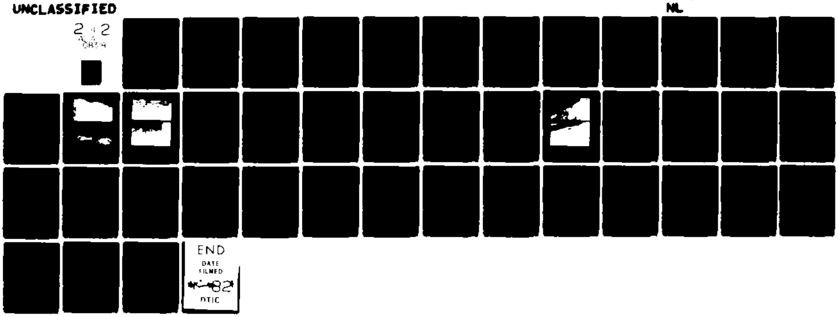

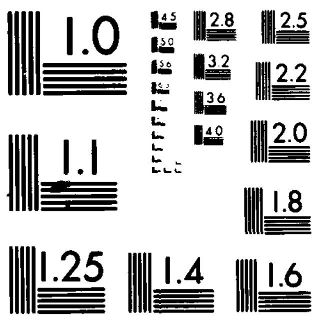

MICROCOPY RESOLUTION TEST CHART
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A completely randomized block design was used and all treatments were replicated 4 times (figure 24). Plot dimensions were 30' x 72' and total plot area was 17,280 sq. ft. Species composition of the plot area prior to overseeding was 100% weeping lovegrass. Lime application of 1.5 tons/A was applied across all plot area prior to seeding using an agricultural grade limestone. Seeding was done with a hand operated cyclone seeder. Discing following seeding was performed with a weighted disc attached to a crawler-type tractor traveling horizontally across the slope. Discing was done in strips 12' wide alternating with 12' wide non-disced area horizontally across the slope. Discing in strips rather than discing the entire plot area was done to avoid excessive soil disturbance.

An initial observation was made on November 21, 1978 and showed establishment of tall fescue, crimson clover and hairy vetch across all plots (table 19). There was noticeably greater establishment of the overseeded species in the disced areas compared to areas not disced. Establishment of the overseeded species was greater in plots planted at the high seeding rate compared to the low seeding rate. Soil erosion was not noticeable across all plots and discing did not significantly affect slope stabilization. Weeping lovegrass in the disced area showed rapid regrowth following discing.

An observation on March 7, 1979 also showed greater seedling establishment on plots seeded to the higher seeding rate compared to the lower rate. Soil erosion was not noticeable across all plots. The weeping lovegrass and bahiagrass cover was essentially dormant at the time of this observation, however, spring-up was beginning

as noticed by emergence of green shoots from the crown of these species.

An observation on May 24, 1979 continued to show greater establishment of the overseeded species seeded at the high compared to the low seeding rate. The disced area showed greater establishment of these overseeded species compared to the non-disced areas. Hairy vetch shoot growth at the time of this sampling dominated the total cover. Hairy vetch plants were infested with aphids (*Macrosiphum spp*.) and symptoms of a leafspot plant disease was also noticed on the hairy vetch. Neither the disease or insect infectation appeared to be significantly damaging the vigor of the hairy vetch. Soil erosion was similar and not noticeable across all plots. The weeping lovegrass in the disced area showed 60-70% re-establishment at the time of this observation.

An observation on August 31, 1979 showed similar findings as reported at the May 24, 1979 observations. Hairy vetch and crimson clover had completed their life cycle at the time of this observation as evident by total senescence of both these species.

An observation on October 10, 1979 showed decreased seedling establishment of the hairy vetch and crimson clover compared to the initial establishment density. Tall fescue density also decreased compared to its initial establishment density. The % cover decreased also, however, soil erosion was not affected and slope stabilization was good overall. No noticeable differences in overseeding establishment was observed between plot seeded at the two seeding rates.

An observation on May 27, 1980 showed decreased stand establishment for all overseeded species across all plots. There was no

noticeable difference between seeding rates and overseeding stand density. Slope stabilization was good and overall soil erosion was not noticeable across all plots. The decrease in density of overseeded species as measured at this observation is attributed to several factors. The high initial stand density of hairy vetch dominated the overseed species and inhibited initial establishment of crimson clover and tall fescue. The poor reseeding of hairy vetch the following season resulted in low stand density of hairy vetch. The initial inhibition of crimson clover and tall fescue reduced the density of these species such that reseeding and/or stand establishment was limited. The combination of poor reseeding of hairy vetch and poor initial stand establishment of crimson clover and tall fescue resulted in the decrease in density of the overseeded species.

Summary:

This study evaluated two seeding rates of a seed mixture of hairy vetch, crimson clover and tall fescue used to overseed a dense stand of weeping lovegrass. Discing horizontally in alternate strips across the plot area resulted in good initial establishment and did not alter slope stabilization. The higher seeding rate showed greater initial density of the overseeded species during the 1st growing season. Hairy vetch dominated the plots in the disced area during the 1st growing sèason and inhibited establishment of crimson clover and tall fescue. Reseeding of hairy vetch during the 2nd growing was poor. Initial inhibition of the crimson clover and tall fescue resulted in poor reseeding and/or stand establishment the following season. Hairy vetch was shown to dominate the

overseeded stand and inhibit establishment of other species. In addition, hairy vetch showed poor reseeding ability. Fall overseeding is a desirable practice, however, hairy vetch inclusion within a seed mix for overseeding is questionable.

Table 19. The effects of seeding rate of overseeded tall fescue, hairy vetch and crimson clover into an established stand of weeping lovegrass on species composition, % cover and soil erosion control initiated September 13, 1978 on a 2H:IV west slope exposure at the Tenn-Tom Waterway Site (Section 4A) in Tishomingo Co., MS.

Observation Date	Seed Mixture	Seeding Rate	Species Composition: Weeping lovegrass	Species Composition: Tall fescue	Species Composition: Hairy vetch	Species Composition: Crimson clover	% Cover	Soil Erosion
		--lbs/A--	---------------	%	---------------			
9-21-78	tall fescue	15	70	5	15	10	85	none
5-24-79	hairy vetch	15	68	5	22	5	80	none
10-10-79	crimson clover	10	78	3	12	7	70	none
5-27-80			85	2	5	8	72	none
9-21-78	tall fescue	30	60	5	20	15	88	none
5-24-79	hairy vetch	30	62	5	25	8	85	none
10-10-79	crimson clover	20	75	4	15	6	75	none
5-27-80			88	2	5	5	76	none

TREATMENTS:

Treatment 1 (T1) - 'Ky 31' tall fescue (15 lbs/A); hairy vetch (15 lbs/A); and 'Dixie' crimson clover (10 lbs/A).

Treatment 2 (T2) - 'Ky 31' tall fescue (30 lbs/A); hairy vetch (30 lbs/A); and 'Dixie crimson clover (10 lbs/A).

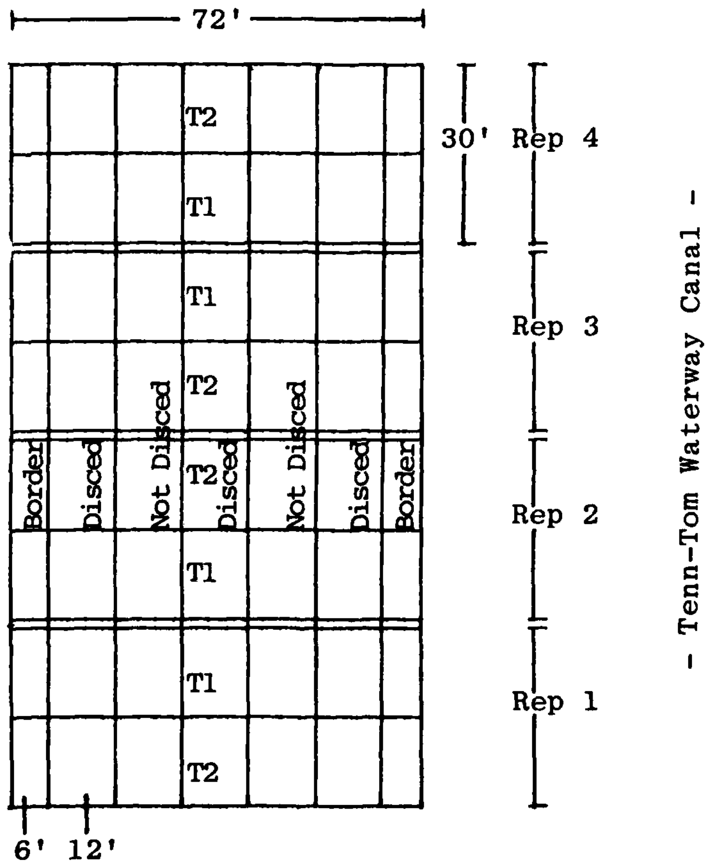

Figure 24: Field plot diagram of Overseeding Study III - 1978 initiated September 13, 1978 in a completely randomized block design located on a 2H:IV west slope exposure at the Tenn-Tom Waterway Site (Section 4A) in Tishomingo Co., MS.

Overseeding Study IV - 1979

The Overseeding Study IV - 1979 was initiated on May 14, 1979 on plot area located at the Tenn-Tom Waterway Site (Section 4B) on a 2H:IV east slope exposure.

The plant species used in this study were bahiagrass (_Paspalum notatum_, cv. 'Pensacola'), and sericea lespedeza (_Lespedeza cuneata_, cv. 'Serala').

Treatment combinations used in this study included the following:

Clod-busted

Treatment 1 - Bahiagrass (25 lbs/A); and sericea lespedeza (30 lbs/A).

Treatment 2 - Bahiagrass (50 lbs/A); and sericea lespedeza (60 lbs/A).

Treatment 3 - Bahiagrass (25 lbs/A); and sericea lespedeza (30 lbs/A) and a broadcast application of 2 tons/A limestone.

Treatment 4 - Bahiagrass (50 lbs/A); and sericea lespedeza (60 lbs/A) and a broadcast application of 2 tons/A limestone.

Non-clod-busted

Treatment 5 - Bahiagrass (25 lbs/A); and sericea lespedeza (30 lbs/A).

Treatment 6 - Bahiagrass (50 lbs/A); and sericea lespedeza (60 lbs/A).

Treatment 7 - Bahiagrass (25 lbs/A); and sericea lespedeza (30 lbs/A) and a broadcast application of 2 tons/A limestone.

Treatment 8 - Bahiagrass (50 lbs/A); and sericea lespedeza (60 lbs/A) and a broadcast application of 2 tons/A limestone.

This study was designed to evaluate two seeding rates of bahiagrass (25 and 50 lbs/A) and sericea lespedeza (30 and 60 lbs/A) and preplant application of limestone (2 tons/A). In addition, the use of a Clod-Buster[1] was investigated for pre-plant incorporation of limestone and seedbed preparation prior to the overseeding.

Seedbed preparation on slopes prior to overseeding had been investigated in prior studies using burning, and shallow discing. Shallow discing has shown benefit as a means to improve seedling establishment by reducing establish stand competition. Discing horizontally across a steep slope (2H:IV) is hazardous and can cause excessive slope damage if not properly performed. This study evaluated a clod-buster as an alternate method of seedbed preparation. The clod-buster consists of a heavy weight chain with 3/4" x 12" re-inforcing rod welded at measured intervals along the chain and a weight suspended at one end. The unit is drawn from the end opposite the weight and pulled parallel to and along the top of a slope. Cultivation using clod-buster on a slope surface is achieved without equipment traveling on the slope surface per se.

Soil analysis and soil particle size distribution results

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[1] A trade name of a cultivation implement used to cultivate slope surfaces. Manufactured by The Finn Equipment Company, Cincinnati, Ohio 45208.

of soil representative of the plot area are presented in table 20.

Table 20. Soil particle size distribution, phosphorus, potassium, pH and lime requirements of soil representative of Overseeding Study IV - 1979 located at the Tenn-Tom Waterway Site (Section 4B) on a 2H:IV west slope exposure in Tishomingo Co., MS.

Soil pH	Lime Requirement	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution sand	silt	clay	Soil Textural Classification
	--tons/A--	--lbs/A--	--lbs/A--		%		
5.4	2.0	(560)H†	(140)L	81.6	10.2	8.2	Loamy Sand

† (H) and (L) denotes high and low level of availability of nutrient for plant growth and reproduction, respectively.

A completely randomized block design was used and all treatments were replicated 3 times. Plot dimensions were 30' x 78' and total plot area was 28,080 sq. ft. All plots were seeded using a hand operated cyclone seeder. Lime was applied at a rate of 2.0 tons/A using a pelletized limestone source ($CaCO_3$). The clod-buster was pulled horizontally across the slope surface 4 times following lime distribution and prior to seeding. Immediately following seeding the clod-buster was pulled 2 times across the slope surface to insure good soil seed contact.

Species composition for both clod-busted and nonclod-busted plots prior to treatment initiated was 80-85% weeping lovegrass, 1 10-15% sericea lespedeza and 0-5% bahiagrass. The % cover across all plot area prior to initiation ranged between 40-60%.

An initial observation on August 21, 1979 on the clod-busted plot showed 6 to 8 fold increased in sericea lespedeza established compared to its density prior to overseeding (table 21). Seeding rate and lime application did show some affects on species composition, however, these differences were not consistent. The % cover

increased approximately 2 to 3 fold across the clod-busted plot area. Observations on the nonclod-busted plot area also showed increased sericea lespedeza density, however, density increased only 2 to 3 fold in magnitude compared to levels prior to overseeding. Bahiagrass establishment remained similar to density levels observed prior to overseeding.

An observation on May 27, 1980 showed slight increases in sericea lespedeza density on clod-busted plots. Sericea lespedeza density increased significantly on nonclod-busted plots. Bahiagrass established decreased across all clod-busted and nonclod-busted plots. Lime and seeding rate treatments showed little or no effect on species composition or % cover. Overall, % cover was similar across all plots.

A final observation on October 27, 1980 showed little change in sericea lespedeza density across all plots. Bahiagrass density, however, increased noticeably and exceeded levels observed prior to overseeding on clod-busted plots. Nonclod-busted plots showed no change in bahiagrass density compared to the previous observation date (May 27, 1980). The % cover was relatively similar across all plots. Lime and seeding rate treatments showed only slight influence on species density or % cover.

Slope stabilization was not affected by clod-busting. Soil erosion was monitored at all three observation dates and slope condition did not change compared to observations made prior to overseeding.

Summary:

This study evaluated the overseeding of sericea lespedeza

and bahiagrass at 2 seeding rates, lime application and cultivation using a clod-buster prior and following overseeding into a dense weeping lovegrass stand. The clod-buster improved initial establishment of sericea lespedeza 6 to 8 fold and increased overall cover. Lime and seeding rate treatments did not noticeably effect species composition or % cover. Bahiagrass density decreased slightly then increased on clod-busted plots. Nonclod-busted plots showed an increase in sericea lespedeza density, however, this increase was gradual and occurred over a 1 year period following study initiation. Bahiagrass density decreased and remained below levels initially observed prior to overseeding.

The clod-buster did prove to be beneficial. It reduced competition from the established stand as well as create a favorable seedbed. It should be noted, however, that use of a clod-buster be adjusted to stand densities or season of the year such that excessive vegetation is not present which can clog and entangle the unit. Proper use and scheduling of the clod-buster can result in this cultivation equipment being an effective tool.

Table 21. The effects of seeding rate of overseed sericea lespedeza and bahiagrass, lime application and clod-busting on species composition, % cover and soil erosion on plot area located at the Tenn-Tom Waterway Site (Section 4B) on a 2H:IV west slope exposure in Tishomingo Co., MS.

Observation Date	Seed Mixture	Seeding Rate	Lime Application	Clod-busted	Species Composition: Weeping lovegrass	Species Composition: Sericea lespedeza	Species Composition: Bahiagrass	% Cover	Soil Erosion
		-lbs/A-	--tons/A---		%	%	%		
8-21-79	Bahiagrass	25	0	yes	15	84	1	80	none
5-27-80	Sericea lespedeza	30			8	92	0	93	none
10-27-80					20	70	8	93	none
8-21-79	Bahiagrass	25	0	no	61	37	2	75	none
5-27-80	Sericea lespedeza	30			20	80	0	70	none
10-27-80					23	83	0	72	none
8-21-79	Bahiagrass	25	2	yes	17	80	3	85	none
5-27-80	Sericea lespedeza	30			8	92	0	97	none
10-27-80					11	70	7	93	none
8-21-79	Bahiagrass	25	2	no	75	22	3	73	none
5-27-80	Sericea lespedeza	30			33	67	0	70	none
10-27-80					22	77	0	72	none
8-21-79	Bahiagrass	50	6	yes	21	78	1	83	none
5-27-80	Sericea lespedeza	60			8	92	0	90	none
10-27-80					17	83	5	92	none
8-21-79	Bahiagrass	50	0	no	57	42	1	74	none
5-27-80	Sericea lespedeza	60			17	83	0	77	none
10-27-80					27	73	2	73	none
8-21-79	Bahiagrass	50	2	yes	13	87	0	80	none
5-27-80	Sericea lespedeza	60			8	92	0	83	none
10-27-80					15	78	5	90	none
8-21-79	Bahiagrass	50	2	no	67	32	1	82	none
5-27-80	Sericea lespedeza	60			23	77	0	77	none
10-27-80					30	70	1	85	none

TREATMENTS:

Clod-Busted

Treatment 1 (T1) - 'Pensacola' bahiagrass (25 lbs/A), 'Serala' sericea lespedeza (30 lbs/A).

Treatment 2 (T2) - Pensacola bahiagrass (50 lbs/A); 'Serala' sericea lespedeza (60 lbs/A).

Treatment 3 (T3) - 'Pensacola' bahiagrass (25 lbs/A); 'Serala' sericea lespedeza (30 lbs/A) plus 2 tons/A limestone pellets.

Treatment 4 (T4) - Pensacola bahiagrass (50 lbs/A); 'Serala' sericea lespedeza (60 lbs/A) plus 2 tons/A limestone pellets.

Nonclod-Busted

Treatment 1 (T1) - 'Pensacola' bahiagrass (25 lbs/A), 'Serala' sericea lespedeza (30 lbs/A).

Treatment 2 (T2) - Pensacola bahiagrass (50 lbs/A); 'Serala' sericea lespedeza (60 lbs/A).

Treatment 3 (T3) - 'Pensacola' bahiagrass (25 lbs/A); 'Serala' sericea lespedeza (30 lbs/A) plus 2 tons/A limestone pellets.

Treatment 4 (T4) - Pensacola bahiagrass (50 lbs/A); 'Serala' sericea lespedeza (60 lbs/A) plus 2 tons/A limestone pellets.

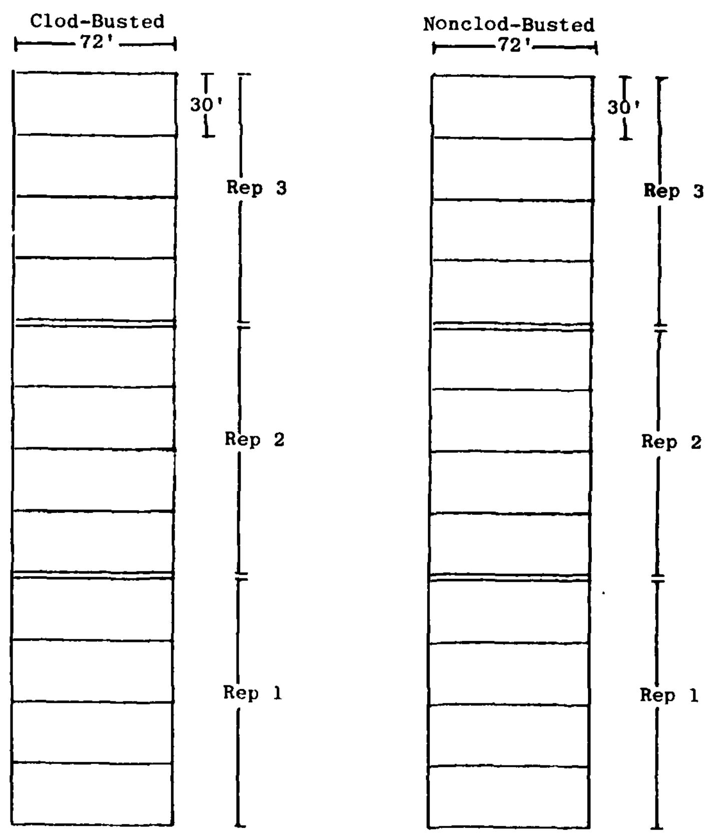

Figure 25: Field plot diagram of Overseeding IV - 1979 initiated on May 14, 1979 in a completely randomized block design located on a 2H:IV east slope exposure at the Tenn-Tom Waterway Site (Section 4B) in Tishomingo Co., MS.

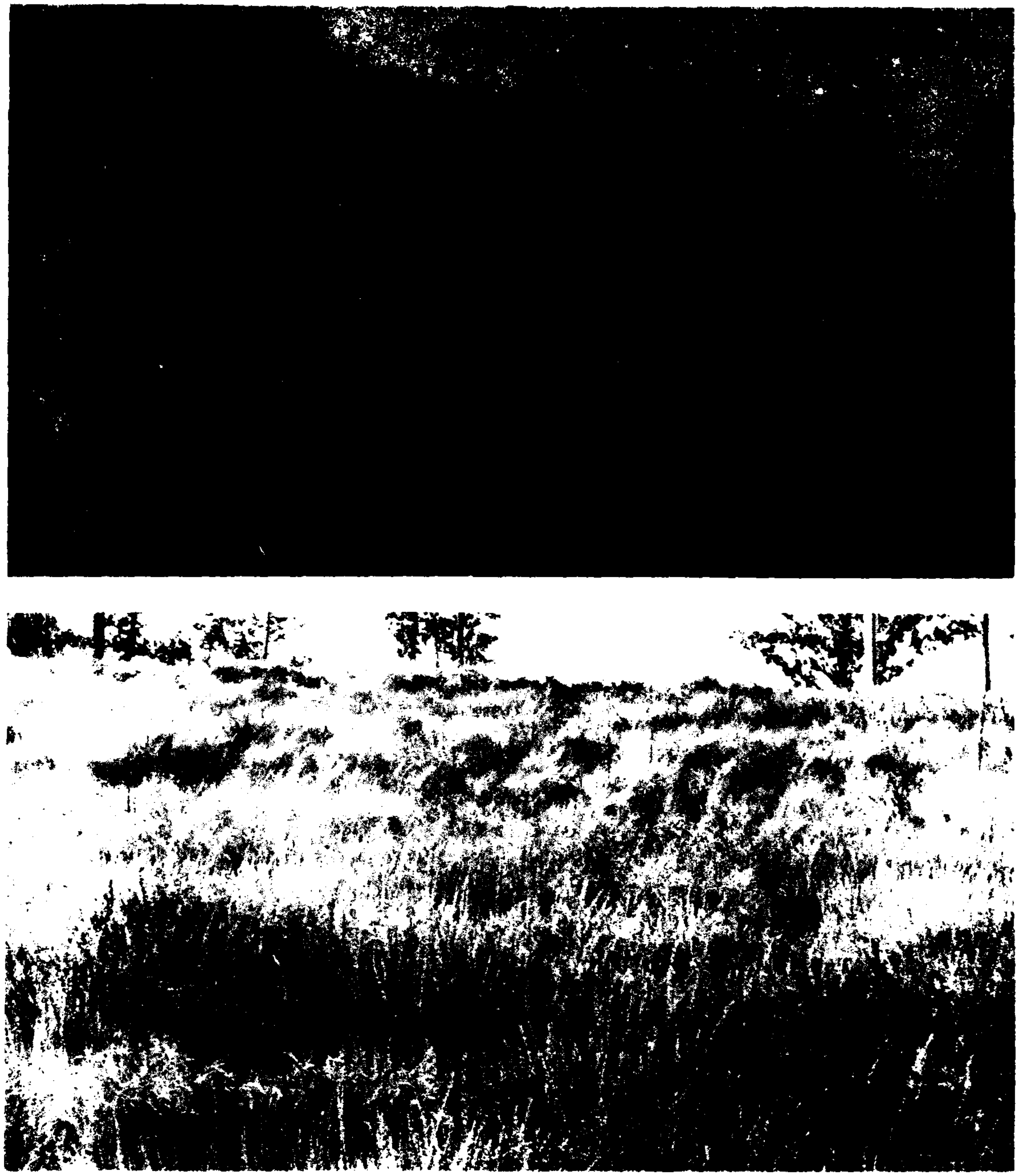

Figure 26. Plot area representative of Overseeding Study IV - 1979. (Top) Plot area overseeded with 25 lbs/A bahiagrass and 30 lbs/A sericea lespedeza without clod-busting Overall stand density is low and limited establishment of the overseeded species Picture taken on July 20, 1979. (Bottom) Plot area overseeded with 25 lbs/A bahiagrass and 30 lbs/A sericea lespedeza with clod-busting. Overall stand density is high and noticeable establishment of overseeded species. Picture taken on July 20, 1979

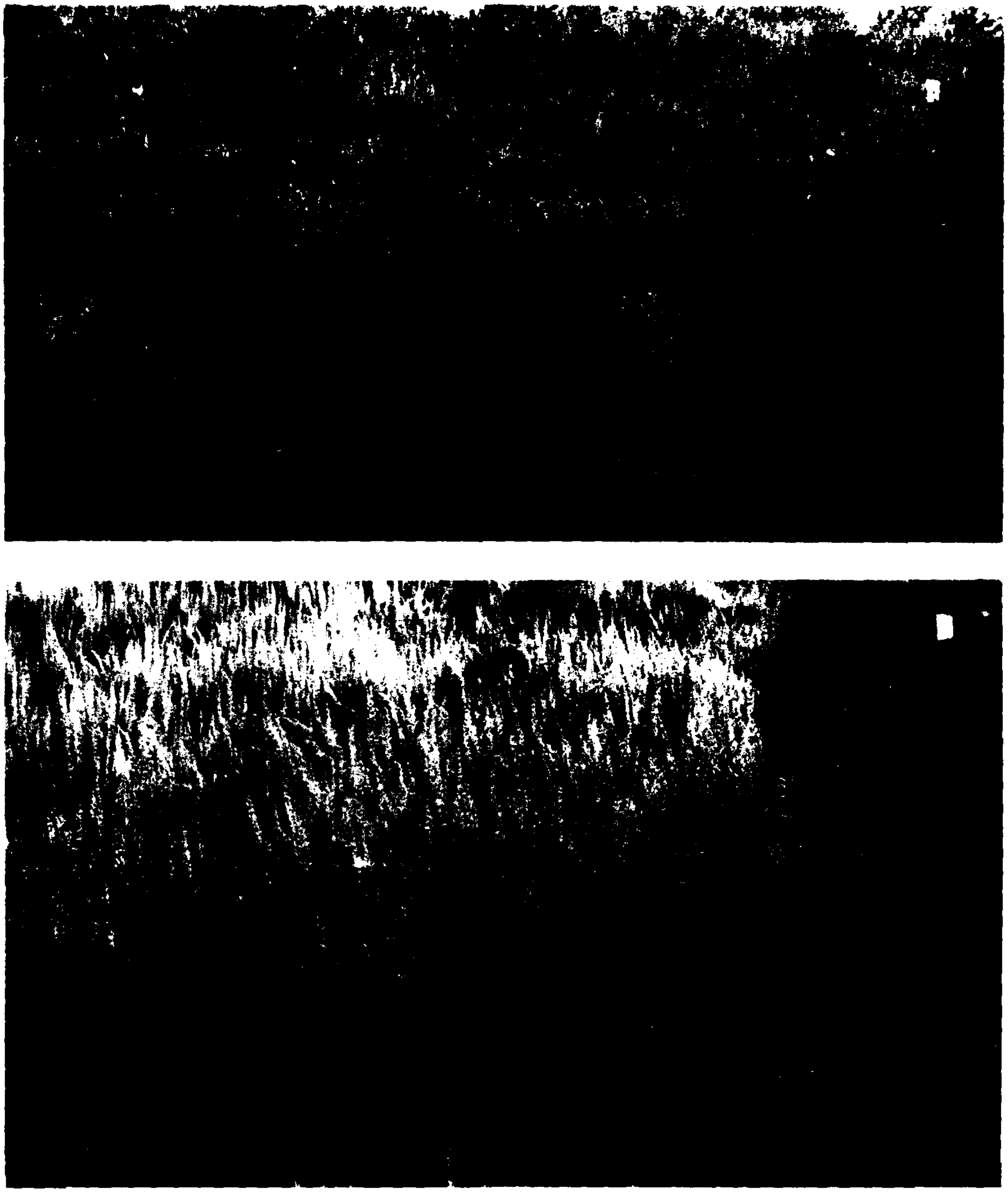

Figure 27. Plot area representative of Overseeding Study IV - 1979. (Top) Plot area overseeded to a seed mix containing 25 lbs/A bahiagrass and 30 lbs/A sericea lespedeza without clod-busting. Shows high density of sericea lespedeza. Picture taken June 1, 1980 approximately 14 months after overseeding. (Bottom) Plot area overseeded to a seed mix containing 25 lbs/A bahiagrass and 30 lbs/A sericea lespedeza with clod-busting. Also shows high density of sericea lespedeza. Picture taken June 1, 1980 approximately 14 months after overseeding.

Overseeding Study V - 1980

Overseeding Study V - 1980 was initiated on May 6, 1980 on plot area located at the Tenn-Tom Waterway Site (Section 4B) on a 2.5H:IV east slope exposure.

The plant species used in this study were tall fescue (Festuca arundinacea cv. 'Kentucky 31'), sericea lespedeza (Lespedeza cuneata cv. 'Serala' 76', 'Interstate', and 'Interstate 76'), white clover (Trifolium repens cv. Louisiana Sl), red clover (Trifolium pratense cv. 'Orbit' and 'Kenland').

Treatment combinations used in this study included the following:

Treatment 1 - 'Kentucky 31' tall fescue (10 lbs/A) and 'Interstate' sericea lespedeza (30 lbs/A).

Treatment 2 - 'Kentucky 31' tall fescue (10 lbs/A) and 'Interstate 76' sericea lespedeza (30 lbs/A).

Treatment 3 - 'Kentucky 31' tall fescue (10 lbs/A) and 'Serala' sericea lespedeza (30 lbs/A).

Treatment 4 - 'Kentucky 31' tall fescue (10 lbs/A) and 'Louisiana Sl' white clover (4 lbs/A).

Treatment 5 - 'Kentucky 31' tall fescue (10 lbs/A) and 'Orbit' red clover (10 lbs/A).

Treatment 6 - 'Kentucky 31' tall fescue (10 lbs/A) and 'Kenland' red clover (10 lbs/A).

This study was designed to evaluate the overseeding establishment of the selected cool and warm season plant species seeded into a low density stand of sericea lespedeza and weeping lovegrass. Most optimal seeding date of a cool season legume is in the fall season. Spring establishment of cool season legume has been shown

to be possible for those species capable of surviving summer temperatures and drought. Selected white and red clover cultivars were used because of their reported tolerance to high temperatures and drought compared to other available cool season legumes.

Soil analysis and soil particle size distribution results of soil representative of the plot area are presented in table 22.

Table 22. Soil particle size distribution, phosphorus, potassium, pH, lime requirements of soil representative of Overseeding Study V - 1980 located at the Tenn-Tom Waterway Site (Section 4B) on a 2.5 H:IV west slope exposure in Tishomingo Co., MS.

Soil pH	Lime Requirements	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution sand	silt	clay	Soil Textural Classification
	---tons/A---	---lbs/A--	--lbs/A--		%		
5.1	2	120(L)†	140(L)	87.0	9.0	4.0	Loamy Sand

† (L) denotes low availability of nutrient required for plant growth and reproduction.

A completely randomized block design was used and all treatments were replicated 5 times (figure 28). Plot dimensions were 30' x 70' and total plot area was 63,000 sq. ft. Lime and fertilizer was applied prior to overseeding at 2 tons/A and 500 lbs/A, respectively. Lime was derived from an agricultural limestone source and fertilizer was derived from a commercial 0-24-24 fertilizer. The entire plot area was clod-busted 4 times for lime and fertilizer incorporation and seedbed preparation. Seed was applied using a hand operated cyclone seeder. Immediately following seeding, the clodbuster was pulled across the plot area 2 times to insure good soil-seed contact.

Species composition of the slope area prior to overseeding showed 60-70% sericea lespedeza, 20-25% weeping lovegrass and

5-10% bahiagrass. The % cover was approximately 40-50% across all plots.

An initial observation on May 27, 1980 showed seedling establishment of both the overseeded cool and warm season legume species (table 23). Both cultivars of red clover showed greater seedling establishment compared to the white clover plots. Tall fescue seedlings were not noticeable at the time of this observation. Seedlings of 'Interstate', 'Interstate 76' and 'Serala 76' were not distinguishable from seedlings of 'Serala' sericea lespedeza which originated from the past years seed crop. The % cover increased across all plots compared to stand density prior to overseeding. The % cover varied between plots, however, these variations were not representative of differences due to overseeding establishment. Slope stabilization was not affected by clod-busting.

An observation on October 27, 1980 revealed no noticeable establishment of the cool season or warm season overseeded legumes. Bahiagrass density increased noticeably compared to the intial observation. The % cover increased for all plots and overall stand density was good. Soil erosion was similar and not noticeable across all plots. This increase in % cover and bahiagrass density is attributed to the refertilization and lime application as well as the influences of clod-busting.

Summary:

This study evaluated overseeding selected cool and warm season legumes and tall fescue to improve stand density. A spring seeding resulted in good initial establishment of all legume species.

However, high temperature stress and droughty condition following establishment caused severe kill of both the cool and warm season overseeded legumes. Overall stand density did increase significantly and is attributed to lime, refertilization and clod-busting.

Table 23. The effects of overseeding selected legume species into a low density stand of weeping lovegrass and sericea lespedeza on species composition, % cover, and soil erosion on a 2H:IV east slope exposure located on the Tenn-Tom Waterway Site (Section 4B) in Tishomingo Co., MS.

Observation Date	Seed† Mix	Seeding Rate	Species Composition: Previous Seeded Species: 'Serala' sericea lespedeza	Previous Seeded Species: Weeping lovegrass	Previous Seeded Species: Bahiagrass	Overseeded Species: Legume‡	Overseeded Species: Tall fescue	% Cover	Soil Erosion
		-lbs/A-	%						
5-27-80	tall fescue	10	88	6	6	§	0	62	none
10-27-80	'Interstate' SL	30	70	10	20	0	0	65	none
5-27-80	tall fescue	10	85	14	5	-	0	52	none
10-27-80	'Interstate 76' SL	30	68	12	20	0	0	70	none
5-27-80	tall fescue	10	85	10	5	-	0	49	none
10-27-80	'Serala 76' SL	30	72	12	15	0	0	75	none
5-27-80	tall fescue	10	79	6	5	9	0	62	none
10-27-80	'Louisiana Sl' WC	4	72	8	20	0	0	70	none
5-27-80	tall fescue	10	56	5	5	32	0	60	none
10-27-80	'Orbit' RC	10	76	10	14	0	0	75	none
5-27-80	tall fescue	10	54	5	5	36	0	46	none
10-27-80	'Kenland' RC	10	75	10	15	0	0	70	none

† SL - abbreviation for sericea lespedeza; WC - abbreviation for white clover; and, RC - abbreviation for red clover.

‡ Legume heading encompasses all 6 warm and cool season legume species listed and values representative of the legume species listed in each row.

§ Separation of cultivars of sericea lespedeza was not possible at the time of observation and valves combined under 'Serala' sericea lespedeza.

TREATMENTS:

Treatment 1 (T1) - 'Kentucky 31' tall fescue (30 lbs/A); and, 'Interstate 76' sericea lespedeza (30 lbs/A)

Treatment 2 (T2) - 'Kentucky 31' tall fescue (30 lbs/A); and, 'Interstate 76' sericea lespedeza (30 lbs/A).

Treatment 3 (T3) - 'Kentucky 31' tall fescue (30 lbs/A); and, 'Serala 76' sericea lespedeza (30 lbs/A).

Treatment 4 (T4) - 'Kentucky 31' tall fescue (30 lbs/A); and, 'Louisiana S1' white clover (10 lbs/A).

Treatment 5 (T5) - 'Kentucky 31' tall fescue (30 lbs/A); and, 'Orbit' red clover (10 lbs/A).

Treatment 6 (T6) - 'Kentucky 31' tall fescue (30 lbs/A); and, 'Kenland' red clover (10 lbs/A).

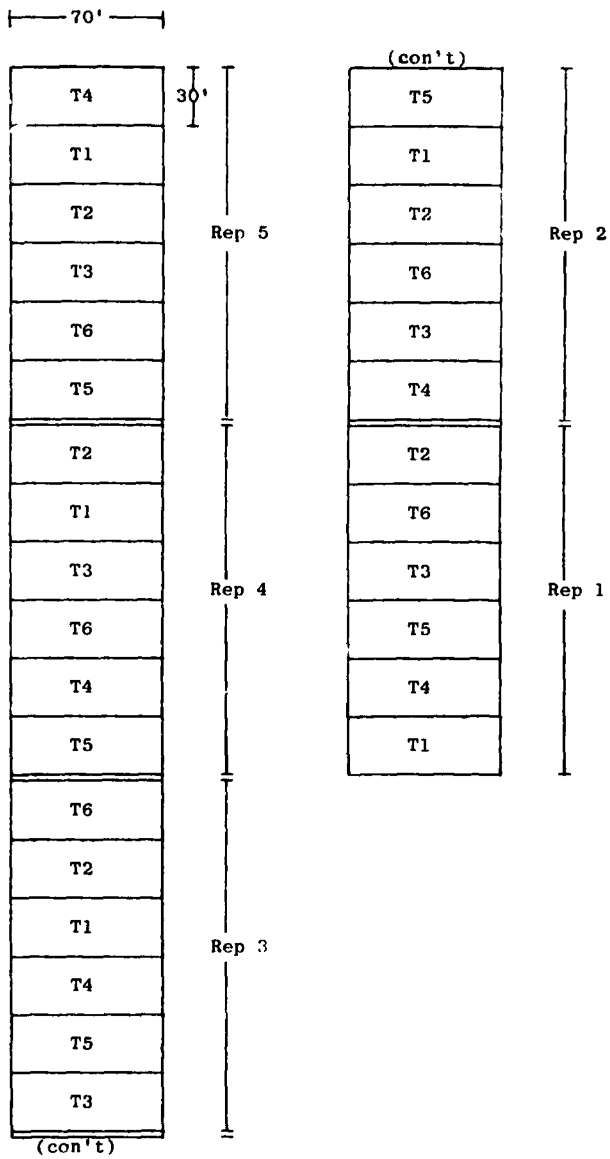

Figure 28: Field plot diagram of Overseeding Study V - 1980 initiated May 6, 1980 in a completely randomized block design located on a 25H:IV west slope exposure at the Tenn-Tom Waterway Site (Section 4B) in Tishomingo Co., MS.

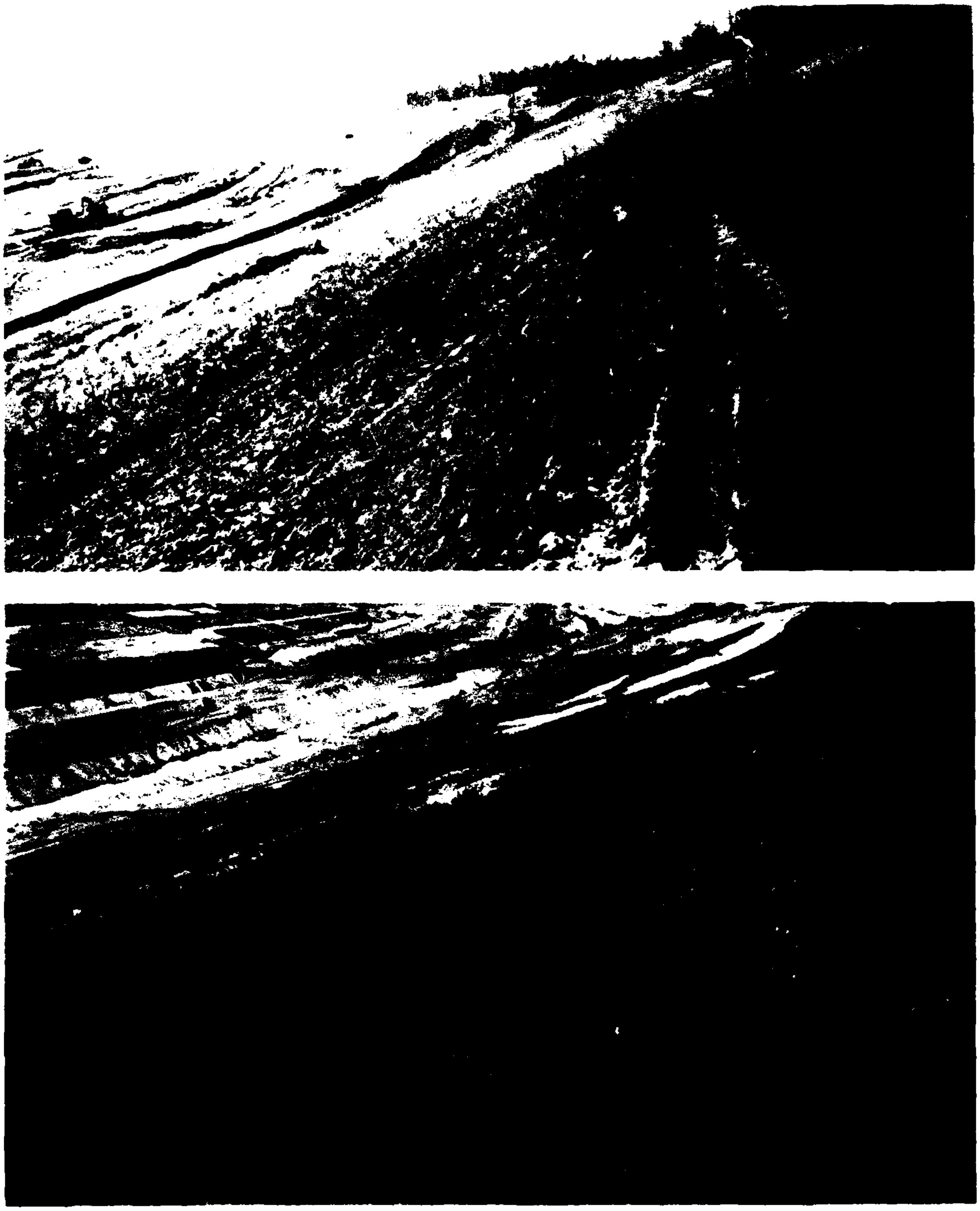

Figure 29. Plot area representative of Overseeding V - 1979. (Top) A clod-buster was pulled across the plot surface for reducing competition of the established vegetation as well as preparing a seedbed. Picture taken on May 6, 1980. (Bottom) The same plot area showing a high density of sericea lespedeza. Picture taken July 1, 1980.

Refertilization Study I - 1978

Refertilization Study I - 1978 was initiated on May 11, 1978 on a plot area located at the Tenn-Tom Waterway Site (Establishment Study V - 1977) on a 2H:IV east slope exposure .

The plant species present on the plot area (Establishment Study V - 1977) were white clover (Trifolium repens cv. 'Regal'); red clover (T. pratense cv. 'Kenland'); subclover (T. subterraneum cv. 'Mt. Barker'); crimson clover (T. incarnatum cv. 'Dixie'); and hairy vetch (Vicia villosa).

Treatment combinations used in this study included the following:

Treatment 1 - 100 lbs/A of 0-24-24 fertilizer.

Treatment 2 - control - no fertilizer.

This study was designed to determine if a plant response of selected legume species could be observed by an application of a 0-24-24 fertilizer on a soil with deficient levels of both nutrient as base on a soil analysis. Legume species have been reported to respond to adequate levels of P and K and may be critical for persistent growth.

Soil analysis and particle size distribution of a soil sample representative of the plot area are presented in table 24.

Table 24. Soil particle size distribution, phosphorus, potassium, pH, and lime requirements of soil representative of Refertilization Study I - 1978 (Establishment Study V - 1977) on a 2H:IV east slope exposure.

Soil pH	Lime Requirements	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution sand	silt	clay	Soil Textural Classification
	——tons/A——	————lbs/A————					
5.5	1.5	42(L)†	102(L)	90.5	3.6	5.9	Sand

† (L) denotes low availability level of nutrient for plant growth and reproduction.

This study was designed as a demonstration and plots used were established by selecting the bottom 1/2 of the slope for fertilizer treatment and the top 1/2 as the control. The field plot diagram is shown in figure 30. Plot dimensions were 20' x 15' and total plot was 9,000 sq. ft. Fertilizer was derived from a 0-24-24 agricultural grade and applied with a hand operated cyclone spreader.

An initial observation on June 21, 1978 showed no noticeable differences in plant vigor or color between fertilized and non-fertilized plots for all legumes.

A second observation on October 18, 1978 showed no noticeable plant responses to fertilization. Soil test taken on October 18, 1978 showed a pH of 5.6 and high and medium levels of phosphorus and potassium, respectively, on plots receiving 100 lbs/A 0-24-24. Non-fertilized plots showed low phosphorus and potassium and pH of 5.7.

An observation on March 7, 1979 continued to show no noticeable influence of refertilization on the legume species.

Observations on October 27, 1979, May 21, 1980, and October 21, 1980 once again showed no plant response to refertilization as compared to non-fertilized plots.

Summary:

This study evaluated the effects of refertilization of selected legume species with a 0-24-24 fertilizer based on soil analysis which showed low plant availability of phosphorus and potassium. No plant response in terms of color, vigor, persistence or reseeding abilities were observed between fertilized and non-fertilized plots. This study provides an indication of the

relationship between plant responses, soil analysis and fertilization with phosphorus and potassium. Additional studies are required between soil analysis and refertilization with P and K using legume species before comprehensive refertilization guidelines can be established.

N

TREATMENTS:

Treatment 1 (T1) - 0-24-24 fertilizer and 100 lbs/A.

Treatment 2 (T2) - no fertilizer.

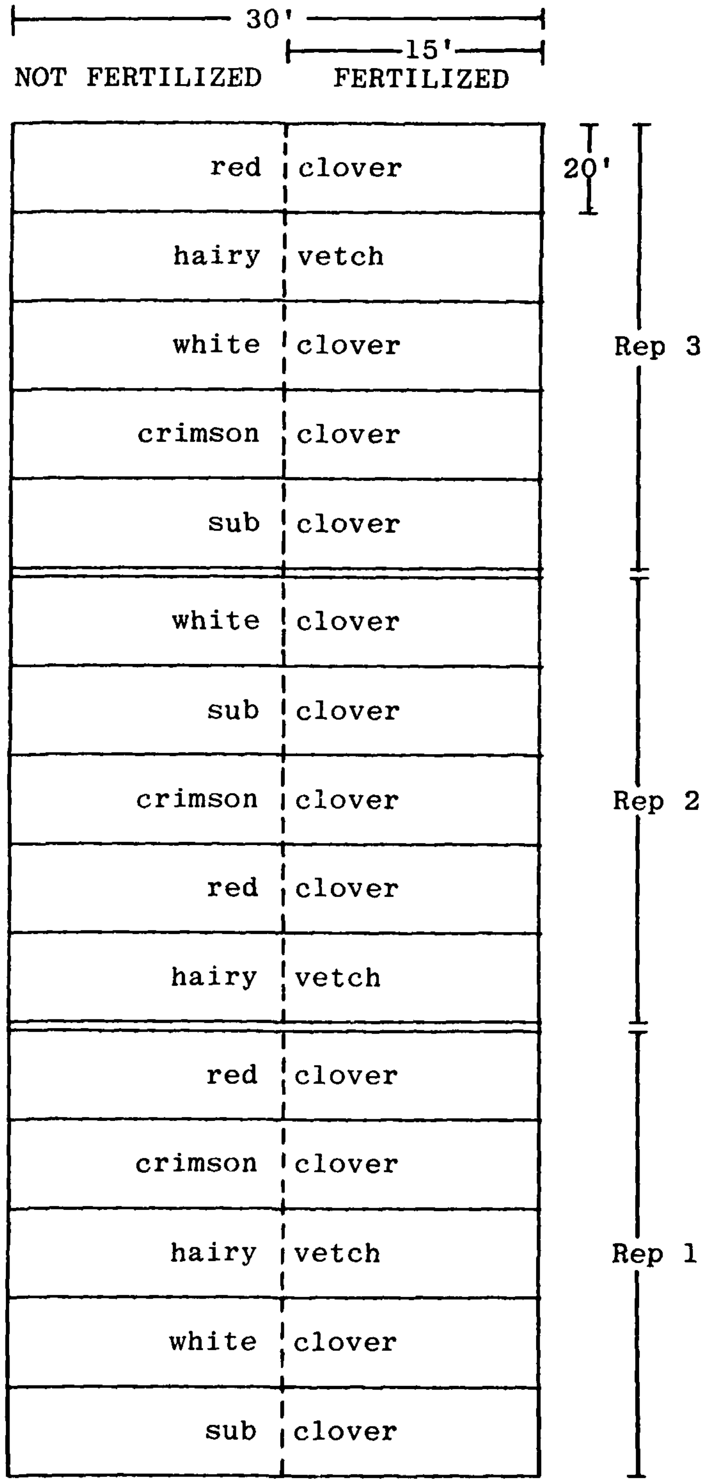

Figure 30: Field plot diagram of Refertilization Study I - 1978 initiated May 11, 1978 located on a 2H:IV east slope exposure (Establishment Study V - 1977) at the Tenn-Tom Waterway Site in Tishomingo Co., MS.

Refertilization Study II - 1978

Refertilization Study II - 1978 was initiated on May 11, 1978 on a plot area located at the Tenn-Tom Waterway Site (Test Trench) on a 2H:IV east slope exposure.

The plant species present on the plot area were weeping lovegrass (*Eragrostis curvulus*) and sericea lespedeza (*Lespedeza cuneata*).

Treatment combinations used in this study included the following:

Treatment 1 - 200 lbs/A of a 33-0-0 fertilizer material.

Treatment 2 - no fertilizer application.

This study was initiated to evaluate nitrogen fertilization on species composition, plant vigor, and soil erosion control. Nitrogen fertilization following slope stabilization is not considered as a long term maintenance practice. Nitrogen fertilization was evaluated on this site with respect to the improvement of stand density and the maintenance of soil erosion control until overseeding or other cultural practices could be used to permanently improve stand persistence and soil stabilization.

Soil analysis and particle size distribution for a soil sample representative of the plot area are presented in table 25.

Table 25. Soil particle size distribution, phosphorus, potassium, pH and lime requirements of soil representative of Refertilization Study II - 1978 (Test Trench) on a 2H:IV east slope exposure.

Soil pH	Lime Requirements	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution sand	silt	clay	Soil Textural Classification
		---lbs/A---					
5.5	1.5	147(M)†	204(M)	84.1	12.0	3.9	Loamy Sand

† (M) denotes a medium level of nutrient availability f-· ·lant growth and reproduction.

A completely randomized block design was used and all treatments were replicated 4 times (figure 31). Species composition of the plot area was 90-95% weeping lovegrass and 0-5% sericea lespedeza. The stand density was low and % cover was estimated at 40-50%. Soil erosion was rated as slight to moderate. Nitrogen was derived from a 33-0-0 agricultural grade fertilizer applied with a hand operated cyclone spreader.

An initial observation on June 7, 1978 showed an increase in the % cover on the fertilized compared to the non-fertilized plots. Species composition and soil erosion showed no difference between treatments.

An observation on July 19, 1978 showed an increase in the % cover compared to the last observation on the fertilized plots. The % cover and soil erosion remained unchanged.

Observations made on November 11, 1978 and May 24, 1979 showed no change in % cover, species composition or soil erosion compared to the July 19, 1978 observation.

Summary:

This study was designed to evaluate nitrogen fertilization as a means to improve stand density and vigor for short-term soil erosion control maintenance. A 200 lbs/A ammonium nitrate fertilization resulted in increased stand density of a slope composed primarily of weeping lovegrass. This use of nitrogen fertilization may be important on sites of low density and/or marginal soil erosion control to hold soil erosion in check until overseeding or other cultural practices can be used to permanently improve stand density.

Table 26. The effects of nitrogen fertilization on species composition, % cover and soil erosion initiated May 11, 1978 on a 2H:IV east slope exposure at the Tenn-Tom Waterway Site (Test Trench) in Tishomingo Co., MS.

Observation date	Ammonium† nitrate	Species Composition		% Cover	Soil‡ Erosion
		Weeping lovegrass	Sericea lespedeza		
	--lbs/A--				
6-1-78	0	92	8	45	none
7-19-78		90	10	48	none
11-21-78		94	6	50	none
5-24-79		91	9	41	none
6-1-78	200	93	7	52	none
7-19-78		93	7	65	none
11-21-78		94	6	60	none
5-24-79		90	10	62	none

† Application rate refers to a total fertilizer application and amounts to 66 lbs/A of actual nitrogen applied.

‡ Soil erosion is based on soil erosion observed following initiation of the study. Soil erosion on the plot area was rated as slight to moderate prior to the initiation of this study.

TREATMENTS:

Treatment 1 (T1) - 33-0-0 fertilizer at 200 lbs/A.

Treatment 2 (T2) - no fertilizer.

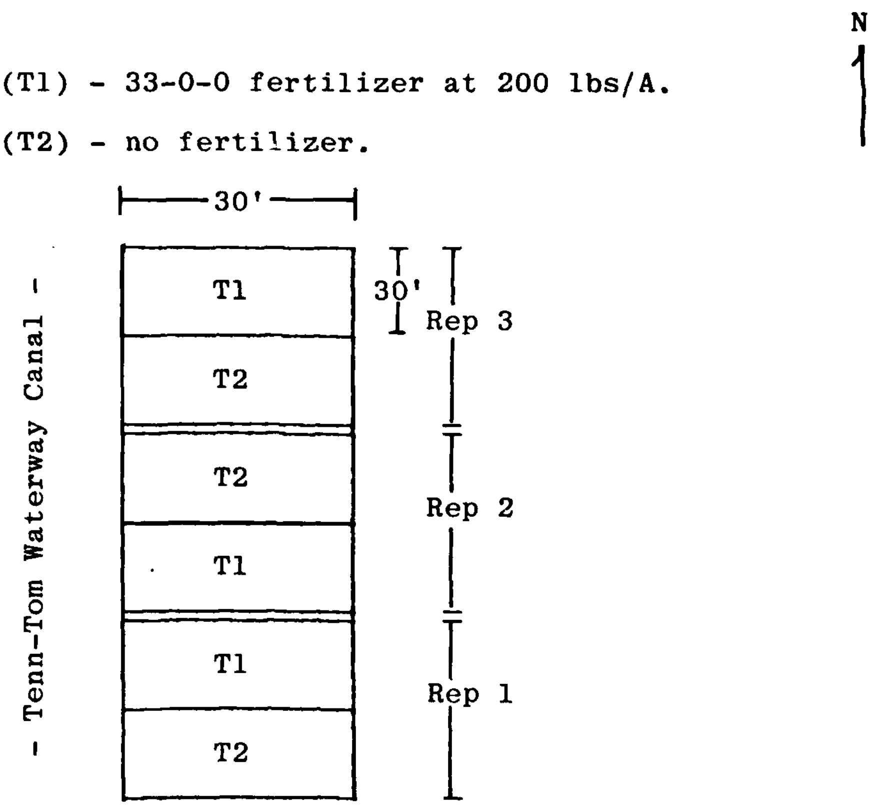

Figure 31: Field plot diagram of Refertilization II - 1978 initiated May 11, 1978 in a completely randomized block design located on a 2H:IV east slope exposure at the Tenn-Tom Waterway Site (Test Trench) in Tishomingo Co., MS.

Refertilization Study III - 1978

Refertilization Study III - 1978 was initiated on May 16, 1978 on a plot area located at the Tenn-Tom Waterway Site (Section 4A) on a 2H:IV west slope exposure.

The plant species present on the plot area was weeping lovegrass (*Eragrostis curvulus*).

Treatment combinations used in this study included the following:

Treatment 1 - no fertilizer.

Treatment 2 - 100 lbs/A 33-0-0

Treatment 3 - 200 lbs/A 33-0-0

Treatment 4 - 400 lbs/A 33-0-0

This study was initiated to evaluate nitrogen fertilization of weeping lovegrass prior to overseeding. Regrowth rate of weeping lovegrass and overseeding establishment were monitored to evaluate the effects of nitrogen fertilization. Previous studies had shown increased density of weeping lovegrass following nitrogen fertilization.

Soil analysis and soil particle size distribution results of soil representative of the plot area are presented in table 17. A completely randomized block design was used and all treatments were replicated 3 times (figure 32). Plot dimensions were 30' x 30' and total plot area was 10,800 sq. ft. Species composition of the plot area prior to overseeding was 100% weeping lovegrass. Stand density was estimated at 85-90% cover. Fertilizer was derived from a 33-0-0 agricultural grade fertilizer and applied with hand operated cyclone spreaders.

An initial observation on June 21, 1978 revealed darker green

foliage coloration and greater plant height for plots receiving N fertilization compared to non-fertilized plots. The 400 lbs/A N treatment show noticeably darker green foliage coloration compared to other N treatments. Stand density was similar across all plots.

A later observation on July 19, 1978 showed similar responses as previously reported during the June 21, 1978 observation.

An overseeding study (Overseeding Study III - 1978) was initiated on Sept. 13, 1978[1]. Regrowth of weeping lovegrass was greater for all treatments receiving N fertilization compared to non-fertilized plots. Slope stabilization following discing was not altered and similar across all levels of N fertilization. Establishment rate of overseeded species was not affected by N fertilization treatments.

Summary:

This study evaluated N fertilization prior to overseeding. Parameters monitored to evaluate N fertilization were rate of weeping lovegrass regrowth, overseeding establishment and soil erosion. Regrowth following overseeding was more rapid on all N fertilization plots compared to plots not receiving N. Overseeding establishment was similar across all levels of N fertilization. Soil erosion was not affected by discing or N fertilization treatment. N fertilization prior to overseeding was not shown to be detrimental or benficial to seedling establishment. The inherent rapid regrowth of weeping lovegrass following discing was sufficient

[1] See Overseeding Study III - 1978 for more detailed information on establishment procedures.

without nitrogen fertilization to maintain slope stabilization.

N

TREATMENTS:

Treatment 1 (T1) - Control, no fertilization.

Treatment 2 (T2) - 100 lbs/A of a 33-0-0.

Treatment 3 (T3) - 200 lbs/A of a 33-0-0.

Treatment 4 (T4) - 400 lbs/A of a 33-0-0.

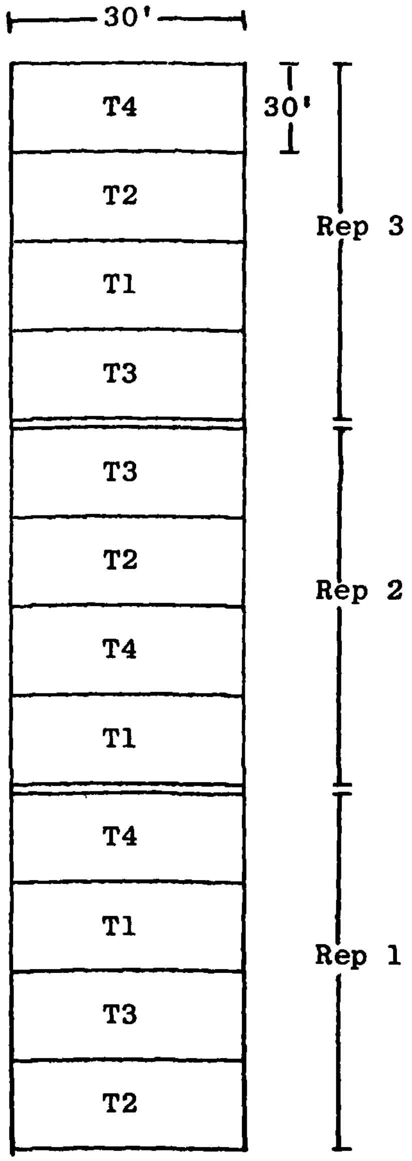

Figure 32: Field plot diagram of Refertilization Study III - 1978 initiated May 16, 1978 in a completely randomized block design located on a 2H:IV west slope exposure at the Tenn-Tom Waterway Site (Section 4A) in Tishomingo Co., MS.

Refertilization Study IV - 1978

The Refertilization Study IV - 1978 was initiated on August 4, 1978 on a plot area located at the Tenn-Tom Waterway Site (L&N railroad relocation 2 miles east of waterway canal) on a 2.5H:IV east slope exposure.

The plant species present on the plot area (Establishment Study VI - 1978) were weeping lovegrass (*Eragrostis curvulus* Schrad. Nees.); common bermudagrass (*Cynodon dactylon* L. Pers.); bahiagrass (*Paspalum notatum* Flugge cv. 'Pensacola'); and sericea lespedeza (*Lespedeza cuneata* cv. Serala).

Treatment combinations used in this study included the following:

Treatment 1 - no fertilizer.

Treatment 2 - 800 lbs/A of 10-20-10 fertilizer.

This study was designed to evaluate species composition, % cover and soil erosion of a weeping lovegrass stand to a fertilization application of 800 lbs/A of 10-20-10 compared to no refertilization. Previous studies have shown benefit to nitrogen refertilization on low density stands for improving or maintaining soil erosion control.

Soil analysis and particle size distribution results are presented in table 27.

Table 27. Soil particle size distribution, phosphorus, potassium, pH and lime requirements of soil representation of Refertilization IV - 1978 located at the Tenn-Tom Waterway Site (L&N railroad relocation 2 miles east of waterway canal)on a 2.5H:IV east slope exposure.

Soil pH	Lime Requirement	Phosphorus (P_2O_5)	Potassium (K_2O)	Soil Particle Distribution sand	silt	clay	Soil Textural Classification
	—tons/A—	———lbs/A———					
5.9	.5	108(M)†	102(M)	90.1	7.6	2.3	Sand

† (M) denotes medium availability of nutrient for plant growth and reproduction.

The plot study was designed as a demonstration and was located on Establishment Study VI - 1978. Plot area consisted of the bottom 1/2 receiving the fertilizer treatment and the top 1/2 as the control or non-fertilized area (figure 33). Species composition was 100% weeping lovegrass and % cover was estimated at 80-95%. Fertilizer was derived from a 10-20-10 agriculture grade material and applied with hand operated cyclone spreaders.

Observations on November 21, 1978 showed weeping lovegrass with noticeably darker green foliage and slightly higher vertical growth compared to the non-fertilized plots. Overall stand density was similar between fertilized and non-fertilized plots.

An observation on May 24, 1979 continued to show slightly darker green vegetation and higher vertical growth on the fertilized compared to the non-fertilized plots. Stand density was similar between fertilized and non-fertilized plots.

An observation on October 19, 1979 showed a more noticeable difference between fertilized and non-fertilized plots. The plot receiving 800 lbs/A of a 10-20-10 showed greater and more noticeable differences in stand height and foliage color. Foliage in the plots without refertilization showed a purple coloration near

the tips and the leaves appeared dry and brittle. The fertilized plot showed slightly greater stand density compared to the non-fertilized plots.

An observation on October 25, 1980 showed less noticeable differences between fertilized and non-fertilized plots. Species composition, % cover and soil erosion were similar between fertilized and non-fertilized plots. The overall effects of the fertilization appeared to have diminished noticeably at the time of this observation.

Summary:

This study was designed to evaluate the effects of a refertilization using a 10-20-10 analysis at 800 lbs/A rate. Species composition, % cover and soil erosion were monitored over time. Immediate effects of refertilization was observed in stand color and height. Stand density increased slightly, however, it decreased back to a level similar to the non-fertilized plot by the last observation. Soil erosion was similar between fertilized and non-fertilized plots throughout the study. The observed affects of refertilization lasted approximately 2 years.

TREATMENTS:

Treatment 1 (T1) - Control - no fertilizer.

Treatment 2 (T2) - 800 lbs/A of a 10-20-10.

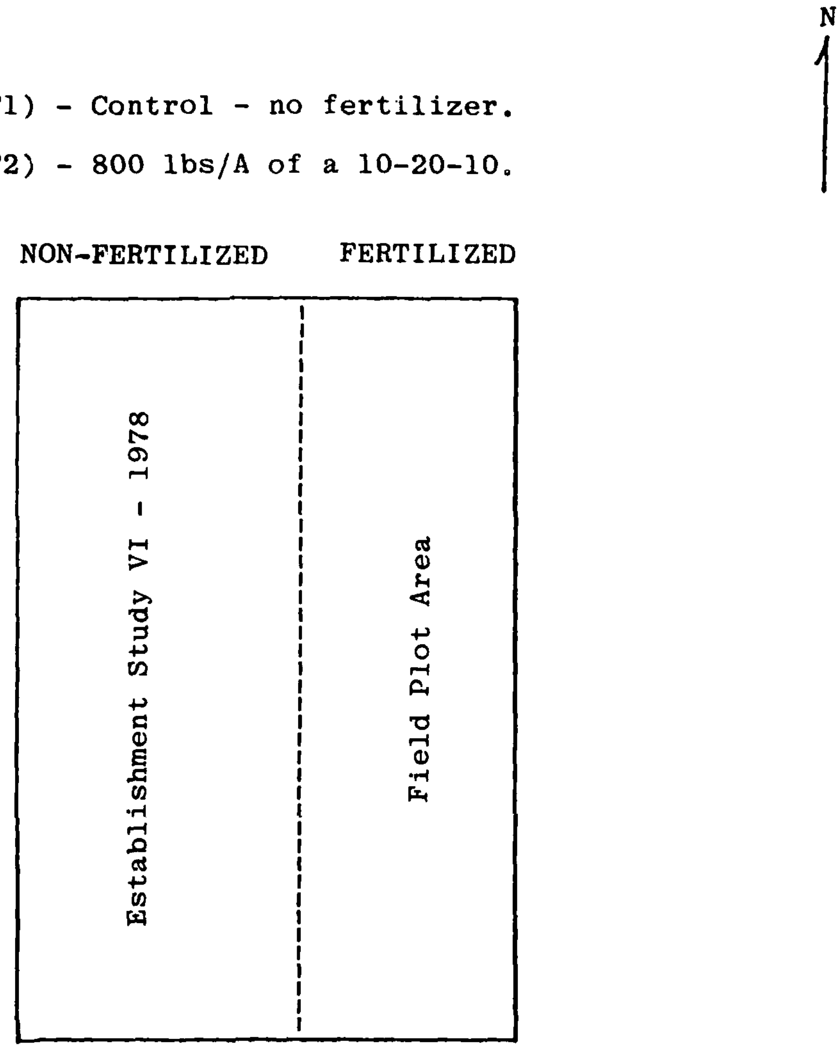

Figure 33: Field plot diagram of Refertilization IV - 1978 initiated August 4, 1978 on Establishment Study VI - 1978 plot area located on a 2.5H:IV east slope exposure at the Tenn-Tom Waterway Site (L&N railroad relocation 2 miles east of Waterway Canal) in Tishomingo Co., MS.

Summary

The research studies presented herein were conducted over a 4 year period from August 1976 to October 1980. Primary objectives were focused on species selection, seeding rates, mulch evaluations, post-establishment fertilization and over-seeding. Studies were divided into subject areas of establishment, overseeding or refertilization. Plot locations were at two sites in Tishomingo Co., MS (Yellow Creek Port Site and Tenn-Tom Waterway Site). All site locations were selected based on soil physical and chemical criteria most representative of the Tenn-Tom Waterway slopes and spoil areas.

ESTABLISHMENT STUDIES

Species shown to be well adaptive to site and soil conditions were weeping lovegrass, tall fescue, rye, annual ryegrass, bahia-grass, sericea lespedeza, and crimson clover. Species which showed moderate adaptation were common bermudagrass and hairy vetch. Common bermudagrass performed well during initial establishment, however, significant bermudagrass winter-kill was noted for 2 consecutive winter seasons. Hairy vetch also established well, but declined after 2 or more seasons due to poor reseeding.

Spring-summer and fall seed mixtures and seed rate which showed rapid establishment and diverse composition of plant species for controlling soil erosion were:

Spring-Summer -	Weeping lovegrass	5-10 lbs/A
	Bahiagrass	35-45 lbs/A
	Sericea lespedeza	20-30 lbs/A
Fall -	Tall fescue	50-60 lbs/A
	Crimson clover	10-15 lbs/A

Plant species and seeding rate most adaptative as a temporary cover when seeded at a late fall seeding date (after November 1) was rye at 80-90 lbs/A. Tall fescue and annual ryegrass did not establish satisfactory when seeded at this late fall seeding date.

Seedling establishment for temporary soil erosion control when seeded during the winter season (February) was not successful for all species (rye, annual ryegrass and tall fescue) evaluated. Soil disturbance by construction activity in the winter season should be avoided if stabilization of the site is required using a vegetative cover.

Legume species which showed best adaptation to site and soil conditions was crimson clover at 10 lbs/A. Other legumes which were established but failed to persist were:

hairy vetch
red clover
white clover
sub clover

East and west slope exposures did not significantly effect relative species composition of test plots. The % cover was greater on west compared to east slope exposures. Soil erosion was similar and not significantly effected by slope orientation. Based on these findings, modifications in seed mixtures and/or seeding rate as related to slope orientation is not required to stabilize slopes.

Seed distribution methods were evaluated as either mixed or contour seeding. Contour seeding consisted of seeding alternate

strips of rapid establishing species (weeping lovegrass and bermudagrass) with slowly establishing species (sericea lespedeza, bahiagrass, crimson clover, and hairy vetch). Contour seeding provided good initial establishment and slope stabilization. Strips of slowly establishing species established well and provided adequate cover of these species. Contour seeding proved to be an effective approach to seeding and may be especially desirable on sites with steep slope angles, excessive slope lengths and/or highly erodable soils.

A straw-asphalt seed mulch at 2 tons straw and 100 gals. of asphalt per acre provide good temporary soil erosion control. A nylon-paper webbing seed mulch provided similar temporary soil erosion compared to straw-asphalt. Noticeable winter-kill of vegetation (common bermudagrass and weeping lovegrass) grown under the nylon-paper mulch occurred during the 1st winter season following a spring establishment. This occurrence of winter-kill of vegetation under the nylon-paper webbed mulches plus the high labor requirement of installation of this mulch deters from the effectiveness of this mulch.

2 or 4 tons/A straw-asphalt mulch or a nylon-paper webbed mulch did not provide effective long term soil protection over the winter season. All mulches temporarily controlled soil erosion, however, prolonged protection without seedling establishment resulted in severe erosion. Construction activities which disturb soil during winter season should be avoided if soil protection is desired using the above mulches.

Dormant seeding establishment with warm season species at

a late fall or winter seeding date was successful for weeping lovegrass and sericea lespedeza. However, severe soil erosion prior to germination of dormant seeding occurred under the mulches evaluated (2 or 4 ton/A straw-asphalt and nylon-paper webbing) and negated the success of dormant seeding. In addition, dormant seeding combined with rye was also ineffective due to the rye competition inhibiting the dormant seeded species from establishing. A one-step procedure of temporary soil erosion control using protective soil mulches or rye followed by permanent spring establishment of warm season species using dormant seeding was not successful overall for controlling soil erosion.

OVERSEEDING STUDIES

Overseeding was performed to integrate plant species into or increase the density of an established vegetative stand. Burning, discing and clod-busting were evaluated as cultivation practices prior to overseeding to reduce competition of the established stand and create a suitable seedbed. Clod-busting was the most effective cultivation method.

Hydroseeding or overseeding with or without presoaked seeds did not improve establishment of the overseeded species. The cool and warm season species and seeding rates which performed well for overseeding included:

Bahiagrass	45 lbs/A
Sericea lespedeza	30 lbs/A
Tall fescue	20 lbs/A
Crimson clover	10 lbs/A

Overseeding proved to be a useful practice that can effectively

intergrate plant species and increase overall stand density.

REFERTILIZATION

Refertilization with nitrogen was evaluated as a short term maintenance practice to maintain slope stabilization prior to overseeding. Application of 50-100 lbs/A nitrogen improved stand density of grass species. Overseeding following nitrogen fertilization showed no detrimental or beneficial effects on establishment of the overseeded species. Regrowth of the established stand following overseeding was greater with prior nitrogen fertilization. Plant response to nitrogen fertilization (80 lbs N/acre) lasted 2 years.